GAS JOURNAL

VOL. 261. No. 4519 102ND YEAR JANUARY 11, 1950

EDUCATION

FOR two reasons the discussion on education at the research meeting of the Institution of Gas Engineers was much livelier than usual. One reason is that the institution, fortunately for the future welfare of the gas industry, is playing an increasingly important role in educational functions. The other is that opportunity was given to the impromptu speaker; and, as we said in our general review of the proceedings, we hope there will be no return to the old over-organised plan of inviting set speakers to read from manuscript. The new associate membership examination will shortly replace the existing ordinary and higher grade examinations in gas engineering and arrangements have been made for students to achieve the standard required through the machinery of national certificate courses. These certificates are the ordinary national certificate in mechanical engineering followed by a higher national certificate in civil engineering. As is pointed out in the current *Bulletin* of the Institution, the courses are lengthy and by evening study alone will require six or seven years to complete. Part-time release from employment on one or two half-days per week, or the equivalent, will considerably reduce the time required. On this question of part-time study, Dr. J. N. Long remarked at the research meeting that at the Westminster Technical Institute, of which he is Principal, about 500 young men from the civil engineering industry attend one day a week to cover the necessary ground for the ordinary and higher national certificates. So far there has been little response from the gas industry.

The broad question of the linkage of the Institution of Gas Engineers and the Institution of Civil Engineers came up for comment at the meeting. Mr. J. H. Dyde shares our view that the linkage gives greater free play for the transference of engineers from one associated industry to another. Mr. T. F. E. Rhead thinks quite otherwise. He regards the linkage as a grave mistake. In gas manufacture, he argued—his remarks will be found in our report of the discussion on another page—that gas engineering is a chemical engineering problem and that there should have been a linkage with the Institution of Chemical Engineers. This, he maintained, should be the nucleus of the education scheme, and he went on to say that mechanical engineers and civil engineers are 'incidental.' They 'wrap the apparatus round the ideas which the chemists and physicists produce . . . The universities are turning their vocational training courses into chemical engineering courses and teaching the applied science of chemical engineering.' And he added that it was not fair to ask a really first-class mind as a chemist or a physicist to join the gas industry. Mr. Rhead quoted Leeds University as an example of the new outlook. A degree course in chemical engineering was instituted there in 1942, and it was a wholly commendable step; but that fact, we would emphasise, has not done away with the vocational training at Leeds in gas engineering. Chemical engineering has not been substituted for gas engineering. Nor do we agree with Mr. Rhead that the gas industry has remained in the rut of what he called the clay-pipe stage of gas manufacture and that the automatic carburetted water gas plant is the only real chemical engineering process it has evolved.

Turning from this particular aspect, however, it is now the duty of the area boards, under section 4 of the Gas Act, 1948, to deal with the training of employees in the gas industry; and as education must be on a national basis it will have to be co-ordinated by the Gas Council. No doubt the Council will take advantage of the excellent educational facilities which the Institution of Gas Engineers is in a positon to offer.

INDUSTRIAL ACCIDENTS

STATISTICS recently published in the annual report of the Chief Inspector of Factories for 1948 disclose that there has been little progress to record in the prevention of accidents in industry. During 1948 factory inspectors were notified of 201,086 accidents in accordance with the 1937 Factories Act, compared with 203,236 in 1947. In 1948, however, 861 of the accidents proved fatal, compared with 839 in the year before. The loss of man-hours caused by these accidents was approximately equal to the loss of 25,000 workers. A fact which seems largely to have militated against improved progress in accident prevention has been the common idea that attention to safety detracts from the production drive. This assumption, says the report, is not tenable in the

light of statistics relating to accidents. It will be recalled that during the peak war years when production was at its highest the number of accidents were relatively even higher, and it needs no intricate argument to prove to the sceptics that had safety organisations been in a position to maintain accident rates at pre-war level then an even higher output would have accrued. The report adds: 'Besides, apart from the losses in manpower due to accidents, it has often been found that greater attention to safe methods of working results in more efficient production.'

The report does, however, register the setting up of many new Safety Committees and the appointment by some firms of Safety Officers for the first time; against this there have to be set many instances of Committees losing interest, of their members being left with insufficient time or influence to permit an efficient discharge of their functions, and of Safety Officers leaving their work for other, and often more remunerative, work without either a suitable or any replacement. On balance the report is of the opinion that some ground has been gained. The Chief Inspector, nevertheless, sees fit to point out that a large proportion of the accidents could have been prevented, and that it is only when a common responsibility is accepted within industry that one can hope for a serious approach to accident prevention.

The dangers arising from new mechanical aids installed to improve productivity are emphasised, but it is considered that as they largely arise from causes in respect of which specific provision can be made they should be of lesser frequency and their control less casual than is the case with manual handling. Many accidents, it is observed, occur because workers take unnecessary risks. The report states that there is reason to be gravely concerned about accidents due to lifting machinery, to transport, and to persons falling; almost half the fatal accidents reported from factories in 1948 were in those categories.

The Senior Medical Officer of Factories in reviewing the incidence of industrial diseases in 1948 reports 233 cases of tar cancer, an increase of 30 over 1947, but a slight decrease on the 1946 figures which occasioned comment in the report of that year. Eighty-seven of the notified cases were due to tar, 112 to pitch, the highest yet recorded; 34 were due to paraffin, and 146 to oil. Attention is drawn to the fact that voluntary periodic medical examinations, which have amply demonstrated their considerable value over many years, are not always well attended by those who are exposed to skin cancer risks. 'Better co-operation,' says the report, 'between the men and their employers is necessary to make possible the detection for early treatment.'

The gradual return to peace-time conditions would appear to have been more noticeable in 1948 than in previous post-war years, and a welcome feature of the report recognises that there has been a general cleaning-up of factories frequently linked with the improvement, installation, or overhaul of lighting arrangements. Gasworks, however, and retort houses especially, occasion some measure of criticism; 'in general they are inclined to be backward' in their provision of adequate lighting facilities, although 'the standard is slowly rising.'

THE CHICAGO INSTITUTE

IN 1939, on the recommendation of the Executive Board of the American Gas Association, a research institute organisation committee was formed. Composed of outstanding leaders of the gas industry this committee was charged with the responsibility of investigating methods for advancing the industry's technology to expand its service to the public. The committee agreed that only through the extension and acceleration of research and through specially trained men could this end be achieved. An institute of gas technology was conceived as an independent research and educational institution to provide specialised research facilities for studying problems pertaining to the gas industry and to provide graduate training in gas technology. As a result the Institute of Gas Technology, Chicago, came into being. It was incorporated in 1941 and was affiliated with the Illinois Institute of Technology and started operations in that year.

The objectives of the Institute are fourfold: To prosecute fundamental and applied research pertinent to the gas industry, to train personnel, to collect and disseminate scientific information for the gas industry, and to correlate research within the industry. Each of these objectives was an integral part of an ambitious plan to promote progress. The plan has been successful and the work is growing apace. This is evident from the annual report of the Institute for 1949 which we have just received and which we have read with great interest. Financial support of the Institute is derived for the most part from associate members (gas undertakings and a few gas appliance and equipment firms) and from contributions. Associate member contracts are on a 10-year basis, and at the end of the fiscal year $311,153 was pledged. Research projects may be carried forward by the research staff either with the Institute's own funds or under the sponsorship of a member undertaking or an association, and there is a stipulation that, apart from appliance development, if the problem is of major importance to the gas industry all patents which result from its study must be made available on a non-exclusive royalty-free basis to the industry. In the case of appliance development exclusive patent rights are granted to the sponsor resulting from work performed in the utilisation laboratory. The programme of the Institute is made up of projects sponsored by the American Gas Association, research sponsored by associated members, sponsored tests, and basic research financed by associate members' dues and contributions. During 1949 the staff numbered 58. Of this number, 37 were engaged in full-time research and teaching, 28 on projects sponsored by the American Gas Association, four on sponsored research and tests, and five in the Institute's basic research programme. As regards training, all the students who graduated entered the gas industry.

It will be gathered from our brief picture of the Institute's organisation and activities that the Institute is now firmly founded and recognised, has a nucleus of young research workers and chemical engineers having specialised training and experience, and is a valuable tool of the research programme of the American Gas Association.

GAS SALES IN AMERICA

THE increasing use of natural gas in the U.S.A., particularly through the change-over of manufactured gas utilities to natural gas, was considered in some detail by Mr. G. H. Rosam in his paper, 'Gas in the Western Hemisphere,' presented recently to the West Riding Gas Salesmen's Circle and published in the *Journal* of last week. Further confirmation of this trend is provided by the Bureau of Statistics of the American Gas Association in its latest bulletin of utility gas sales covering the 12 months ended October 31. During this period overall utility sales of gas reached 34,950 mill. therms, representing an increase of 9.2% over the sales for the corresponding period ending in 1948. Manufactured gas sales during the 12 months declined, however, by 3.9% to 2,262 mill. therms; mixed gas sales at 1,183 mill. therms showed a greater decrease of 9.3%; while sales of natural gas rose by 11.2% to 31,505 mill. therms. Although no figures are available for this period to show the corresponding trend in the number of consumers of manufactured gas, information for the third quarter of last year shows that utilities distributing manufactured gas served 0.3% fewer customers than in the same quarter of 1948. The number of consumers of mixed gas declined by 9.1% over the same period, while the total for natural gas customers increased by 11%.

AREA BOARD MAGAZINE

SOME of the area boards took over the house magazines of one or more of their constituent undertakings and developed them into divisional or area organs, but so far as we are aware the East Midlands Gas Board is the first to launch an entirely new monthly publication of its own. Under the title *Emgas*, No. 1 of Volume 1 appeared last month with a fitting and wholly encouraging introduction by Mr. H. F. H. Jones, Chairman of the board, who hoped that through *Emgas* all who work for the board will develop a sense of unity—of belonging to a team. 'We hope to be able to show you,' he wrote, 'how far your efforts to serve the public are succeeding and to let you see pictures and items of interest from all parts of the area. *Emgas* is not going to be an official circular in which the chairman and other members of the board or of the staff can write instructions or messages for other people to read. It is to be the board's own newspaper and it is just as much open to the youngest and latest joined boy or girl to submit an article and see it published as it is to any more senior person.' Rather more than 50% of the first issue is devoted to news and pictures of domestic and personal activities. At the risk of making the magazine less attractive in the journalistic sense the editor has virtually eliminated magazine features and has concentrated on domestic news value to which all in the area can feel free to contribute. The response, we feel sure, ready as is obvious from the first issue, will grow to the common benefit of all concerned. Printed in two colours on good quality paper, *Emgas* is modern in layout and so full of news items as to present an overcrowded appearance on some of its pages. Possibly when all the district correspondents have got into their stride the number of pages will be increased, and the overall effect will be less attenuated. The magazine is unusual and is decorative. It has made a good beginning, and we anticipate its progress under the editorship of Mr. J. Y. Morfey, for some time one of our own editorial colleagues at 11, Bolt Court.

A ROYAL COMMISSION

SIXTEEN closely printed foolscap folios comprise a report which we have received from New South Wales of a Royal Commission of Enquiry which held 52 public sittings and spent many days last year visiting the works of the Australian Gas Light Company and the North Shore Gas Company, whose affairs were the subject of investigation. The main findings of the Commission are that no variation or modification of the administrative, technical, or industrial practices or methods of the companies is necessary or desirable in the public interest; that while good relationships exist between the companies and their employees a board of enquiry might well consider a superannuation scheme to cover employees, as distinct from members of the staff who are already catered for; that research work undertaken by the Australian Gas Light Company is advantageous, adequate, and not in excess of reasonable needs; and that while improved technological methods have been used it is impossible to say to what extent revenue has been increased or expenditure decreased as a result. The Commission was asked to consider whether in the public interest it was necessary or desirable to extend or amplify the control exercisable under the Gas and Electricity Act of 1935-36 over the companies or either of them, and it replied in the negative. Under extended terms of reference the Commission make recommendations concerning special purposes accounts, discounts to industrial consumers, and standard rates of dividend. Under the last of these headings it is recommended that the 'highly specialised and complicated' process of fixing rates of discount for different classes of consumers should receive the attention of an expert board of enquiry. Finally, the Commission was asked to consider 'to what extent the companies or either of them engage in advertising for the purpose of promoting sales of gas and/or appliances, and whether having regard to the circumstances the amount expended for such purpose is excessive, or the expenditure is necessary.' The answer is that the amounts expended (which in 1948 were £9,948 by the Australian Gas Light Company and £1,231 by the North Shore Gas Company) were not excessive and that the expenditure was justified in view of the number of new appliances coming on the market and competition with makers of rival appliances.

Letters to the Editor

'REFLECTIONS'

DEAR SIR,—With reference to my article in your issue of December 28, I regret that the following sentence will give rise to a misapprehension of the facts:—

> 'This matter of reserves was to some extent due to the refusal of the Ministry of Fuel and Power to grant price increases to cover current costs until reserves had been utilised.'

This statement is fair comment on what took place up to about the end of 1943, but the Gas Division came to the conclusion about that time that this policy was not in the best interests of the industry in view of the post-war programme of renewals and development.

Consequently the comment is not valid since that date, and in fact many undertakings were able to commence rebuilding their reserves, an adequate sum being allowed in the price of gas when included in the budget submitted to the Ministry.

I regret the omission to enlarge on this point in the article, and take this opportunity of making this addition.

Yours faithfully,
GEORGE EVETTS.

"Woodbourn," East Drive,
Virginia Water.
Surrey.
January 4, 1950.

C.W.G.

DEAR SIR,—I was gratified to see my paper on carburetted water gas published so fully in the issue of *Gas Journal* of January 4.

The quotation included in your editorial: '. . . . if capital charges are included at present-day rates, carburetted water gas becomes the cheaper by approximately ¼d. per therm,' though true at the time it was originally written no longer represents the real position owing to a rise in the price of gas oil in the late autumn. The production costs of coal gas and carburetted water gas are now substantially the same if capital charges at present-day rates are included.

Yours faithfully,
S. C. CRATHORN.

Gasworks, Saltley,
Birmingham, 8.
January 6, 1950.

Personal

Mr. **W. Charlton** has been appointed Publicity Manager of the National Benzole Co., Ltd. Educated at Peter Symond's, Winchester, and St. Edmund Hall, Oxford, he joined the company in November, 1935, as a trainee. Soon after he was attached to the sales staff of the London Division and was later transferred to the Brighton area. In 1940 he joined the Navy as an ordinary seaman, rising to the rank of Lieut.-Commander in 1945. Demobilised in February, 1947, Mr. Charlton took a course in advertising at the London Press Exchange, and returned to the publicity department of his own company in February, 1948. An old Oxford soccer blue, Corinthian, and Amateur International, he has played for Barnet, Wimbledon, Yorkshire Amateurs, and—as an amateur—for Southampton, Hull City, and Q.P.R. He was recently elected to the Council of the London Football Association.

◇ ◇ ◇

Mr. **H. W. Bosworth,** Chairman and Managing Director of the Lancashire Dynamo and Crypto Co., Ltd., has retired from the position of Managing Director after 43 years' service with the company. He will continue to act as Chairman and will remain a director.

◇ ◇ ◇

Alderman **T. H. Wheeler,** J.P., of Horseferry Road, S.W.1, has been appointed a member of the North Thames Gas Consultative Council in the place of Mrs. **J. Phillips,** of Newton Road, Westbourne Grove, W.2, who has resigned through pressure of other public work.

◇ ◇ ◇

Mr. **J. R. W. Alexander,** M.A., LL.B., F.C.I.S., has joined the board of Abbot, Birks and Co., Ltd., manufacturers and distributors of gas, water, electrical and general engineering equipment. Mr. **J. Brian W. Birks,** D.F.C., M.A., who is engaged in the technical and research work of the company, has also been elected to the board.

◇ ◇ ◇

Mr. **J. W. Hargreaves** has retired from the position of General Manager of the Renfrew and Dumbarton works of Babcock & Wilcox, Ltd. He is succeeded by Mr. **I. M. Lyon,** Assistant General Manager. Mr. **A. S. Peacock,** Manager of the industrial sales section in the London office, has been appointed Assistant General Manager of the Renfrew and Dumbarton works.

◇ ◇ ◇

Mr. **E. Hutchison,** Manager of the Worksop undertaking of the East Midlands Gas Board, has retired. Mr. Hutchison, who had been with the undertaking since 1908, was presented with a portable wireless set by the former directors, staff, and employees. Mr. **J. K. M. Snell** has been appointed Sales and Service Superintendent at Worksop and Mr. **H. D. Sullivan** has been appointed Engineer.

◇ ◇ ◇

Mr. **Ashley S. Ward,** Chairman of Thos. W. Ward Ltd., since 1941, has resigned from that office, but remains a Director and will act in an advisory capacity. In recognition of his long service the Company has appointed him President. Mr. **George Wood** has been appointed Chairman and Mr. **Frank R. Stagg** Deputy Chairman; Mr. **H. W. Secker,** O.B.E., and Mr. **J. Walton** become Joint Managing Directors; and Mr. **Arnold Carr,** hitherto in charge of London area operations, is to transfer his activities to Sheffield for other important work. Mr. **F. W. Robinson,** a local Director, has been appointed to the full board and will take charge of London area interests.

In addition to the greetings, calendars, and diaries which we acknowledged in last week's issue, we have received a new set of desk calendar date cards for 1950 from R. and J. Dempster, Ltd., and a calendar for either wall or desk from Wellington Tube Works, Ltd.

Obituary

Mr. **Andrew R. Wilson,** who retired from the position of Works Manager of the Perth undertaking last May, died in Bridge of Earn Hospital on December 13 after a long illness. He gave 48 years' service, starting as an office boy under the late Mr. John W. McLusky in 1901 in former works at Scott Street. The Friarton works were opened the same year and Mr. Wilson served there under four successive managers. During this time the annual output rose from 160 mill. cu.ft. to 790 mill. cu.ft.

◇ ◇ ◇

Dr. **T. Lewis Bailey,** a former Chief Inspector of Alkali &c., Works, died at Redhill from heart failure on December 13, at the age of 85. Dr. Bailey was appointed sub-Inspector of Alkali &c., Works in 1908 and for five and half years was in charge of the South Wales district as Assistant to Dr. Fryer. In these years he had a wide experience of the various industries in the West Country including tinplate manufacture in South Wales and arsenic production in Cornwall. During this period the problem arising from atmospheric pollution by tinplate flux works was satisfactorily solved. In 1914 he succeeded Mr. Ballard as Inspector in South West Lancashire, North Wales, and Ireland. In 1920, on the retirement of Mr. Curphey, he was appointed Chief Inspector. During his tenure of office he devoted much time to the question of effluents from ammonia plants and in this connection he was led to consider the whole process of coal gas purification with a view to providing an ammonia liquor of a less noxious character. He also took particular interest in the subject of water scrubbing on Gay Lussac tower gases as a means of reducing the acidity of sulphuric acid plant escapes and in the elimination of sulphur oxides from waste gases arising from the combustion of fuel. He was an original member of the Government Chemist Committee under the chairmanship of Sir Robert Robertson, which was charged with the examination of proposals for gas washing at Battersea Power Station. He retired in 1929 and from that time had lived in south-east England.

WILLIAM JAMES LIBERTY

We regret to record the death of Captain William James Liberty, which occurred at his home at 238, Rosendale Road, Dulwich, S.E.21, on January 6 after a short illness following a fall. Captain Liberty, who was in his 89th year, had been associated with the gas industry for 60 years. His name first appeared in the *Journal* of August 19, 1890, when it was announced that he had been appointed Inspector of Subways and Gas Lighting for the City of London, a post which was afterwards changed to that of Superintendent of Public Lighting. Although he had retired from office he remained active in many spheres until shortly before his death; we recollect in particular a pleasant afternoon spent with him and Mrs. Liberty at the summer meeting of the London and Southern Junior Gas Association at Southampton last June, a few days before his 88th birthday.

On his appointment to superintend the public lighting of the City of London, Captain Liberty continued experiments in illumination in which he had been engaged for some years in the City Engineer's office, and he was specially concerned with the introduction of the Welsbach incandescent mantle for street lighting, the City of London being the first city to be so lighted. Twelve years later he was associated with the formation of the London and Southern Junior Gas Association, of which he was subsequently President for two terms of office; his service to the Association was later recognised by his election to Honorary Membership, and he was often to be seen at meetings of the Association.

He was for 42 years an Associate of the Institution of Gas Engineers. He was probably best known, however, as founder of the Association of Public Lighting Engineers, which celebrated its silver Jubilee last year. He was Secretary of the Association from its formation until 1931 and had since continued to be very regular in his attendance at the annual meetings of the Association, although he had retired from his official position in the City in 1926 on attaining the retirement age of 65.

The funeral takes place at Norwood Cemetery today (Wednesday).

Coke Sales Circle

A meeting of the London and Counties Coke Sales Circle was held on January 5 at Gas Industry House, the Chairman, Mr. F. S. Evans, presiding. The main item on the agenda was a paper by Mr. H. S. Hughes (North Thames Gas Board) on 'The Manufacture and Characteristics of Gasworks Cokes.' Mr. Hughes divided his paper into three sections dealing with the production and preparation of coke at the works, the properties of coke which determine its quality, and the choice of coke which best suits particular appliances. He reached a general conclusion that for most purposes the three main types of gasworks coke, horizontal, intermittent vertical, and continuous vertical, are interchangeable.

It was emphasised, however, that owing to difference in bulk density and also sometimes to differences in the appearance of the coke, it was desirable always to supply the same type of coke to the consumer. The paper evoked a lengthy and interesting discussion particularly from members on the distributing side.

Dr. **F. J. Eaton** (North Thames Gas Board) in mentioning the inevitable variations in moisture content and reactivity of coke from plant which is recognised as obsolete, said that it would help the producers if coke from such plant could be diverted to markets where variations in quality were not so vital or noticeable.

Major **E. Daniel** thanked the author for his contribution which was both valuable and timely when the de-rationing of coke afforded opportunities for increased sales in competition with such fuels as anthracite which remained on ration.

South Eastern Gas Corporation

The Ministry of Fuel and Power announced on December 21 the following compensation values (inclusive of additions under Section 26 of the Act) for the Preference and Ordinary stocks of the South Eastern Gas Corporation, Ltd.

Security	Compensation Value
4% Irred. Cum. Pref. (£1 unit) ...	20/7½
4½% Red. (Cum.) Pref., 1970-80 (£1 unit)	22/8
Ord. (£1 unit)	28/3

Council's Gas Balance

A deputation from the Skegness Urban District Council has interviewed officials of the East Midlands Gas Board on the subject of the retention by the council of the accumulated fund balance of £13,981 on the transfer of the local gas undertaking to the board. At the interview it was made clear that the board had no legal power to meet the request. Reference was made to a claim which Hinckley Council had made against the West Midlands Gas Board for retention of surplus money in the gas fund.

Although the legal position in regard to the Skegness case is not the same as at Hinckley, the Clerk to the Skegness Council has recommended that the Minister of Fuel and Power should be asked to permit the council to retain £2,242, which sum might have been transferred to the relief of rates had the council set up a reserve fund at March 31, 1947. The clerk has also recommended that the facts should be submitted to the local M.P., and that he should be asked to support the representations.

Coal Output for 1949

The total output of coal for 1949 was 215,113,800 tons, compared with a minimum target for the year of 215 mill. tons. Announcing this figure, the Ministry of Fuel and Power disclosed that deep-mined production was 206,674,100 tons, compared with a target of 202 mill. and a 1948 output of 196,721,600 tons when the target was 200 mill. tons. Opencast production for 1949 at 12,439,700 tons was 691,400 tons higher than the 1948 figure, but below the minimum target of 13 mill. tons. Total production last week, the period covering the Christmas holiday, was 2,619,400 tons. The total number of workers for the week ended December 24, at 708,900, showed a decrease of 100, but the number of face workers increased by 400 to 293,900. Final figures for 1949 for the total amount of gas available at gasworks show an increase from 505,369.3 mill. cu.ft. in 1948 to 522,821.5 mill. cu.ft. last year. Electricity sent out for public supply similarly increased from 42,060.1 mill. to 44,887.1 mill. units.

The January Number of the *Leyland Journal*, published by Leyland Motors, Ltd., Leyland, Lancs, includes an article which describes progressive improvements in the internal transport system of the Liverpool gas undertaking. A new Leyland Comet-Dyson articulated vehicle which has been introduced at the undertaking's Linacre works conveys 2,600 tons of coal a week from the north end of the works to the retort house at the south end. Replacing several smaller vehicles by means of its greater capacity of 10½ tons, the vehicle has reduced the transport costs of this particular job from 6d.-6½d. per ton to 4½d.

Diary

Jan. 13.—Scottish Junior Gas Association (Western District): 'Pressure Holder Installations,' A. Austin and A. Johnson (Whessoe, Ltd.).

Jan. 13.—London and Southern Junior Gas Association: 'District Problems,' A. E. Taylor (West Surrey Division, South Eastern Gas Board).

Jan. 16.—Eastern Gas Consultative Council: Meeting, Gas Industry House.

Jan. 17.—Institute of Fuel: 'Downjet Coke Firing for Small Steam Generators,' F. B. Karthauser and G. C. H. Sharpe, 'The Burning of Coke by the Downjet Method,' F. F. Ross and G. C. H. Sharpe, and 'The Coke-Fired Downjet Furnace in Industry,' G. C. H. Sharpe. Institution of Mechanical Engineers, Storey's Gate, St. James Park, S.W.1. 5.30 p.m.

Jan. 18.—Eastern Junior Gas Association: 'Domestic Hot Water,' J. E. Cooper (De La Rue Gas Development, Ltd.). Spalding.

Jan. 19.—Midland Association of Gas Engineers and Managers: 'Making the Best Use of Existing Plant and Providing Extensions with Maximum Economy,' S. K. Hawthorn. Discussion on Liquor Disposal. Queen's Hotel, Birmingham. 2.30 p.m.

Jan. 19.—Southern Association of Gas Engineers and Managers (Western District): Paper by L. T. Minchin. Taunton Demonstration Room, 11.30 a.m.

Jan. 21.—Yorkshire Junior Gas Association: 'Present Day Distribution Problems,' J. Hoskin. Leeds.

Jan. 24.—Southern Association of Gas Engineers and Managers (Eastern District): 'Plant Improvements on a Medium Sized Gasworks,' H. W. Moys (North Thames Gas Board). Gas Industry House, 2.30 p.m.

Jan. 25.—Scottish Junior Gas Association (Western District): Afternoon Visit to Gartsherrie Ironworks and Coke Ovens, Bairds and Scottish Steel, Ltd., Coatbridge.

Jan. 25.—London and Southern Junior Gas Association: Visit to Lines Tri-ang Works, Morden.

Jan. 26.—Midland Junior Gas Association: Visit to works of British Thomson-Houston, Ltd., Rugby.

Jan. 26.—North Thames Gas Consultative Council: St. Ermin's Hotel, Westminster, S.W.1, 2.30 p.m.

Feb. 3.—Scottish Junior Gas Association (Western District): 'Gas Conversions to Commercial Apparatus,' A. Walker (Motherwell); 'Difficulties in Handling Inferior Fuels,' G. W. Laing (Barrhead).

Feb. 10.—London and Southern Junior Gas Association: 'Heat and Water Vapour in Crude Gas,' F. E. Craddock (Research Laboratory, Fulham Works, North Thames Gas Board). Lecture Theatre, North Thames Gas Board, 178-180, Edgware Road, 7 p.m.

Feb. 11.—Midland Junior Gas Association: Dinner and Social Evening. Imperial Hotel, Temple Street, Birmingham, 6 p.m.

Feb. 13.—West Midlands Gas Consultative Council: Meeting, Birmingham, 2.30 p.m.

World Consumption of Sulphate of Ammonia

British Federation's Twenty-Ninth Report

THE twenty-ninth annual report of the British Sulphate of Ammonia Federation for the year ended June 30, 1949—the 52nd year of propaganda work undertaken successively by the Sulphate of Ammonia Committee, the Association, the Federation, Nitram, Ltd., and Imperial Chemical Industries, Ltd.—records that world consumption of fertiliser nitrogen during the year reached the record figure of about 3.5 mill. metric tons of nitrogen. In view of the growing recognition of the vital part played by nitrogen in the production of food, a considerable increase in fertiliser nitrogen capacity is now planned in many countries. Despite setbacks due to wars and economic crises there has been continuous expansion in world fertiliser nitrogen consumption over the last 50 years.

The estimates shown in Table I which are expressed in thousands of metric tons of pure nitrogen for 'fertiliser years' ended June 30, have been compiled from the published information available regarding production and consumption of nitrogen in all countries of the world.

In view of the increased production available the International Emergency Food Council in Washington announced on April 19, 1949, that the system of international allocation of nitrogen fertilisers would cease to operate on June 30, 1949.

Home Production

The figures given in Table II show that the total home production of nitrogen products in 1948 was 17% higher than in 1947 and 9% over 1946. Fertiliser products increased by 16% (7% over 1946) and industrial products increased by 22% (21% over 1946). It will be recalled that 1947 was an exceptional year owing to the fuel shortage.

Agricultural Output

There has been increasing insistence by the Government on the need for a larger total agricultural output and greater official emphasis on the part that fertilisers must play in achieving this end. Some disappointment has been expressed in Ministerial circles on the failure of farmers to sow the wheat acreage required and special price inducements have since been offered in order to recover the lost ground.

Some 300,000 acres which should have been sown with cereals were left under or put back to grass and the total increase in grassland was 420,000 acres. These figures are significant as they account to a great extent for the reduction in demand for sulphate of ammonia for direct application.

The Ministry of Agriculture, through the National Agricultural Advisory Service, intensified the campaign for increased output from grassland and achieved some success in substantially increasing the amount of silage made during the year. Furthermore the practice of grass drying is steadily increasing, both on a co-operative basis and with individual farmers.

Intensive Development

To achieve a large increase in output from grassland a great number of farmers throughout the country will have to raise their standard of management. Recognising this need, Imperial Chemical Industries, Ltd., continued preparations for an intensive and long-term development of this potentially large outlet for sulphate of ammonia.

The regular meetings between the research department's staff and members' technical representatives were continued and well attended. A paper reviewing the general position of by-product sulphate production was read before the Northern Section of the Coke Oven Managers' Association. The research department is collaborating with firms of instrument makers with a view to producing instruments to facilitate operational control. Experiments on the use of more resistant materials of construction are being continued.

On June 30, 1949, the Federation numbered 79 members, including the National Coal Board which represents 28 individual undertakings included in the total of 106 members as at June 30, 1948.

TABLE I

World Production and Consumption of Fixed Nitrogen for all Purposes (In Thousands of Metric Tons).

	1948-49		1947-48		1938-39	
	Production	Consumption	Production	Consumption	Production	Consumption
Europe*	2,058.2	1,993.8	1,701.7	1,757.6	1,978.7	1,857.8
Belgium-Luxemburg	172.7	76.3	155.6	89.1	95.0	68.1
France	195.0	251.3	176.4	244.9	167.5	201.8
Germany — Western Zones	377.2	398.2	244.2	294.4	469.9	397.9
Netherlands... ...	86.8	117.6	78.1	118.0	106.3	97.2
Norway	112.0	30.8	88.4	24.0	97.7	12.8
Italy	120.0	125.4	116.0	115.8	131.1	149.6
United Kingdom ...	358.8	252.4	321.6	245.4	171.0	98.0
Other Europe* ...	635.7	741.8	521.4	626.0	740.2	832.4
Asia†	386.1	642.3	238.7	505.2	525.5	632.7
China and Formosa	4.7	41.0	8.2	48.9	1.2	72.2
India and Pakistan...	9.6	51.2	8.6	41.8	4.3	21.1
Ceylon	—	10.7	—	10.2	—	8.4
Japan proper ...	301.2	370.6	221.4	325.1	338.0	356.6
Other Asia†	70.6	168.8	0.5	79.2	182.0	174.4
Africa	17.4	154.7	17.3	109.5	9.7	106.2
Egypt	0.2	104.7	0.2	66.4	0.2	77.8
Other Africa ...	17.2	50.0	17.1	43.1	9.5	28.4
Oceania	12.6	18.4	9.1	16.8	5.3	18.3
America	1,677.8	1,275.2	1,595.0	1,175.6	593.5	492.3
U.S.A.‡	1,205.0	1,162.8	1,129.9	1,064.5	303.6	443.3
Canada	189.8	42.4	182.9	37.6	61.0	16.9
Chile...	280.8	10.0	280.0	10.7	228.4	5.8
British West Indies ...	—	8.3	—	5.7	—	4.6
Other American ...	2.2	51.7	2.2	57.1	0.5	21.7
World total	4,152.1	4,084.4	3,561.8	3,564.7	3,112.7	3,107.3

* Including U.S.S.R. and Russian Zone of Germany. † Including North Korea and Manchuria. ‡ Including Hawaii and Puerto Rico.

TABLE II

Production of Nitrogen Products and of Ammonium Sulphate in the United Kingdom (Tons of 2,240 lb.).

Calendar year	Nitrogen products (expressed as 25% ammonia)	Included in total: Industrial ammonia products (expressed as 25% ammonia)	Included in total: Sulphate of ammonia as such (actual tons of product)
1939	856,800	263,900	483,300
1946	1,506,500	293,300	833,700
1947	1,408,600	291,200	796,700
1948	1,648,800	355,100	901,000

Home Agricultural Consumption—United Kingdom.

Fertiliser year	Sulphate of Ammonia (Tons of 2,240 lb.)	Sulphate of ammonia 20.6% N	Metric tons Nitrogen in other forms	Total nitrogen
1923-24...	128,000	26,800	7,600	34,400
1930-31...	142,400	29,800	10,400	40,200
1938-39...	179,800	37,600	23,000	60,600
1943-44...	664,041	138,981	42,771	181,752
1944-45...	612,381	128,169	44,305	172,474
1945-46...	552,202	115,574	48,889	164,463
1946-47...	551,208	115,366	48,700	164,066
1947-48...	632,916	132,467	52,943	185,410
1948-49...	593,779	124,276	60,828	185,104

Whessoe Works in 1949

DURING the past year Whessoe, Ltd., have seen a steady flow of orders for gas plant, both for customers at home and overseas. Noteworthy among these are the contracts for complete schemes for gas cooling and wet purification. The schemes comprise condensers, electro-detarrers, and scrubbers, and use has been made in the latter, as well as in individual washer contracts, for provision of emergency standby by dividing the washing installation into two or three units operating in series.

Completed schemes included the second installation for Woodall-Duckham, Ltd., at the North Thames Gas Board's Beckton works, and another is shortly to be put into operation for the South Eastern Gas Board at East Greenwich with a capacity of 32 mill. cu.ft. per day. Orders have recently been received for similar installations at Birmingham and Stockton with capacities of 8.5 and 5 mill. cu.ft. per day respectively, and a further complete stream contract will shortly be undertaken in Scotland.

W.W.-D. electro-detarrers are still in demand, orders having been received for a further 20 installations in the past year. Whessoe have recently put to work three detarrers at Beckton on coke producer gas, which is subsequently used for heating a battery of coke ovens. Hot gas detarring which assists in the effluent disposal problem is being used in the Birmingham scheme already mentioned.

Foreign orders completed include detarrer installations in China and Turkey, and gas coolers and electro-detarrers for coke ovens have been put into operation at Pretoria.

A blast furnace gas cleaning plant to handle 1¼ mill. cu.ft. per hour has been put into operation for Cargo Fleet Iron Company at Middlesbrough, and work commenced on the erection of a 6 mill. cu.ft. per hour plant for Colvilles, Ltd., of Glasgow, a feature of which is the provision made in the design of the precoolers so that the furnaces may be operated at top pressures of up to 10 lb. per sq. in.

In the field of producer gas cleaning Whessoe, Ltd., have also been active. An order has been received for a plant to clean 525,000 cu.ft. per hour of coke producer gas, three gas cleaning plants have been successfully moved to new sites and re-commissioned, and a Whessoe disintegrator is being supplied to the Electric Reduction Company of Canada.

Purifiers for the North Western Gas Board have been completed at Ormskirk, and an order has now been received from the same board for elevated boxes for Warrington to deal with 250,000 cu.ft. per hour.

Storage of gas at pressure has been developed as a solution to the peak load problem. Whessoe, Ltd., have supplied several shop welded pressure holders for this purpose, and a vessel with a releasable volume of 75,000 cu.ft. has been constructed and site welded for West Midlands Gas Board at Wythall. Pressure vessels, cylindrical or spherical, have also been supplied for the storage of liquids for the chemical and petroleum industries. A mobile X-ray plant is regularly employed on erection sites in addition to radiographic examination of shop welded work.

In other spheres, outstanding among Whessoe contracts which are in course of construction are those for wind tunnels for the National Aeronautical Establishment at Bedford and for oil refinery plant at Stanlow, which includes not only storage tanks but also the first catalytic cracking vessels in this country.

1949 has seen extensive reconstruction in the Whessoe works at Darlington, designed to improve production efficiency. Production has continued throughout the changes, and it is hoped before long that the alterations will be completed.

In View of the fact that new branches continue to be formed in the women's organisations and that membership of those existing is increasing, the Newcastle Division of the Northern Gas Board decided to arrange a programme in their Lecture Theatre to attract this ever widening circle of housewives. The syllabus was built up round the main theme, 'Comfort and Beauty in the Home,' and to introduce this feature invitations were issued to all presidents of women's organisations in the Division to an 'At Home' which was held in November. Two session were arranged and a 99% acceptance was attained in each case.

Cornish Gas Association

Members of the Cornish Gas Association met at Truro, on December 6, to hear a lecture on 'Fire Prevention,' by Lieutenant Commander A. Waite (late R.N. Fire Service, Damage Control). The Chairman, Mr. T. J. Greenwood, introducing the lecturer, said the Association had been fortunate in securing his services through Messrs. Renwick Wilton & Dobson, Ltd., well known in the West of England as distributors to the gas industry.

Commander Waite said that there was a correct fire extinguisher for each fire risk to be met in a gasworks and sketched briefly the various types of risks and the correct machine to be used. He gave instances of works using totally inadequate appliances and in some cases had noted that where respirators were needed, only one was kept for use. It was sometimes apparent that ordinary service type respirators were being used and this was quite wrong. Two sets should always be in readiness so that should the first operator meet with an accident, a second afforded rescue.

A demonstration was given of the effect of oxygen when introduced to materials which were apparently non-inflammable. The latest type of CO_2 extinguishers manufactured by Read & Campbell, of London, was demonstrated, as also the carbon tetrachloride extinguisher and CO_2 gas models.

Questions were put by members and the Chairman expressed thanks to the speaker for so ably presenting his subject.

World Power Conference

The 4th World Power Conference will be held in London on July 10 to 15, 1950, and a provisional programme has now been arranged, as well as a large number of day and half-day excursions from London.

Among the technical items are the following from Great Britain :—

National Report : (*a*) A survey of energy resources of the U.K. (*b*) An historical record of the development of these resources and of prime movers for utilising them, covering the period since 1924. (Ministry of Fuel and Power.) 'The Cleaning of Coal,' A. Grounds, Production Department, National Coal Board. 'Coal Specification,' D. Hicks, Scientific Department, R. J. Moffat, and J. K. Matthews, Marketing Department, National Coal Board. 'A Review of Some British Carbonisation Problems : (*a*) Coal Requirements. (Dr. G. E. Foxwell ; C. Johnson, Gas Council.) (*b*) 'Effect of Coal Quality upon the results of gas manufacture as experienced by the North Thames Gas Board.' (Dr. J. Burns, North Thames Gas Board.) (*c*) 'Gas Purification.' (G. U. Hopton, B.A., B.SC., North Thames Gas Board, and W. S. Hubbard, North Western Gas Board.) (Sponsored by the Gas Council). 'Metallurgical Coke.' J. P. Graham, G. E. Hall, and G. W. Lee, British Coking Industry Association.) 'The Preparation and Utilisation of Fuels from Coal Tar.' (Dr. D. McNeil, Coal Tar Research Association.) 'The Recovery of Benzole at Gasworks and at Coke Benzole Association.) 'Developments Ovens.' (G. Claxton, M.SC., National in the Manufacture of Producer Gas from British Solid Fuels.' (R. W. Rutherford, Power Gas Corporation, Ltd., and S. K. Hawthorne, West Midlands Gas Board.) (Sponsored by the Gas Council).

Glasgow Gas Prices

Despite an increase in gas prices of 7d. per 1,000 cu.ft., the Scottish Gas Board expects to lose £200,000 on the Glasgow gas undertaking in the current financial year, and cannot therefore reconsider the decision to increase the price of gas. The board's letter to the Corporation in reply to representations claimed that the department was operating at a substantial loss before it was transferred to the board.

For the 11 months to April, 1949, the loss was £61,921. This figure included a refund of £78,000 for income tax—'a windfall which will not recur.' A number of factors were operating against the board, chiefly the price of coal. There was an increase within a month of vesting date and a previous increase involved greater production costs during the current year. The board hoped that the increased demand for gas would assist the financial position but the year 1949-50 would show a heavy deficit.

The New Tube Works of Stewarts and Lloyds, Ltd., uses gas as a major feature in the production of oil line tube. The unit, the most modern plant of its type in Britain, was completed last year and is now producing a continuous output of seamless tubes, ranging from 10¾ in. to 16 in. in diameter.

Freights, Refrigerators, Meter Rents

North Thames Gas Consultative Council Discussions

A MEETING of the North Thames Gas Consultative Council was held at St. Ermin's Hotel, Westminster, on December 29, Councillor E. Bayliss, Chairman, presiding.

The **Chairman** reported replies from the North Thames Gas Board to questions raised at the previous meeting of the consultative council. A request had been made to the board that they should approach the Railway Executive, if they had not already done so, on the question of 'agreed charges' for the transport of coal by rail. An enquiry had been made by the board which showed that the 'exceptional' rates already granted for railborne coal traffic were the most favourable that it was possible to obtain at the present time. The Railway Executive did not grant 'agreed charges' in respect of coal traffic, and moreover an 'agreed' charge would have to have the approval of the Transport Tribunal, who were required to have regard, among other things, to the net revenue of the Railway Executive. In view of the estimated deficit of £20 mill. in the accounts of the Transport Commission for the current year, the board were of the opinion that the time would be inopportune for raising the question.

The consultative council had asked for information on the limits of variation in the calorific value of gas supplied by the board within the statutory limits laid down by the Gas (Quality) Regulations over a period of from three to six months. The Chairman reported that a control chart showing day to day variations would be available for the council in the near future; meanwhile a table showing maximum and minimum average calorific values for the area over the previous quarter was available.

Refrigerators in New Houses

Information had also been sought on the reasons for the continued long delay in satisfying orders for gas refrigerators. The reply indicated that the major part of the production of these appliances goes for export and output for the home market is restricted by the Government's request for economies and by the control of sheet metal. Figures for the board's district as a whole were not available, but for the former Gas Light district 4,400 refrigerators had been received since January 1, of which 1,200 were appropriated on the instructions of the Ministry of Supply for new housing purposes. The waiting list of prospective purchasers in the district was 15,000. It was thought that the shortage of steel was likely to prevent the large-scale production of refrigerators for anything but export for some time. In discussion members of the council expressed their dissatisfaction with this situation. It was felt that in spite of the Government's policy of allocating refrigerators for new houses it was illogical that refrigerators should be installed by local authorities, often without the knowledge or consent of the prospective tenant, at the expense of those on the waiting list. A resolution was passed that a letter expressing this opinion should be sent to the board.

Another question related to the board's policy on the question of charges for meter rentals. A suggestion had been made that these charges should be abolished and that the costs of meters should be recovered in the price of gas. A calculation for the board as a whole showed that if for the year 1948 meter rents had been abolished it would have been necessary to increase the price of gas by 0.56d. per therm. It was considered that the introduction of such an alternative method would be inequitable in that the contribution to meter costs from large consumers and from nearly all non-domestic consumers would be far too high and would, in fact, subsidise those domestic consumers who used little or no gas.

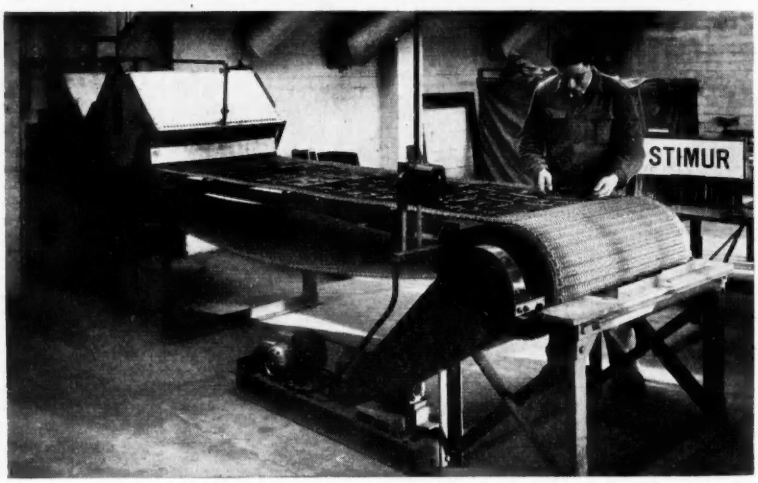
Rural Supplies

The Chairman reported that since the previous meeting of the council a letter had been received from the Cookham (Berks) Rural District Council which asked that consideration should be given to the provision of main gas services in four parishes within their area. These were required to meet the needs of new estates which were being built and the Clerk of the rural council confirmed that a preference had been expressed for gas in these areas. The letter had been sent to the board who at their last meeting had decided that a representative should call on the architect and surveyor of the rural council; a report would be submitted at a later date to the consultative council. A further letter had been received from Mr. George Rogers, M.P. for Kensington North, which raised on behalf of a constituent the question of over-charging by the landlord in the resale of gas to the tenant. This had also been brought to the attention of the board at its last meeting, but in view of certain legal aspects which had to be examined no decision could as yet be taken in the matter.

Requests from two rural district councils, Rochford (Essex) and Bagshot (Surrey), for representation on the consultative council's district committees were considered. It was decided that an additional representative from Rochford should serve on the Essex district committee, and that the committee for Berkshire and Buckinghamshire should be enlarged from 9 to 11 by the inclusion of representatives from Bagshot and Easthampstead.

INFRA-RED DRYING BY GAS

One of the chief problems in the use of paint in industry is the drying process. There are many occasions when, to prevent deterioration in the product, it is essential to dry it as rapidly as possible, and a quick-drying finish will result in an appearance less liable to contamination by dust or dirt. The infra-red gas drying panel installation illustrated in the accompanying photograph is used for drying paint on hydrant identification plates, switch-plates, and signs at the works of the Stimur Manufacturing Company, Paisley. The drying time is 5½ min., which enables the articles to be passed by conveyor directly from the spray booths to the packing department. The installation consists of four panels, handling the output of two full-time spray operators, and together consumes less than 200 cu.ft. of gas per hour. Before the infra-red panel units were installed, it was necessary to spend three quarters of an hour over the stoving of each coat, and the new process, in addition to its considerable speed-up in production time, has also enabled labour to be saved. Plates which had been processed by the infra-red method were subjected to tests, including hammering which dented the base metal but which was unable to effect any chipping of the paint surface. The suppliers of the units were Parkinson and Cowan (Gas Meters), Ltd. The units are 36 in. wide by 18 in. high, and operate at a temperature of 350°F.



Mechanical *v.* Step-Grate Producers

By DR. M. A. SPAGGIARI,
Director, Rome Gasworks, Italgas Company.

***EDITOR'S NOTE*:—The author gives his experience of the heating of two settings of Woodall-Duckham continuous vertical retorts, one by step-grate producers, the other by mechanical producers.**

THE Woodall-Duckham continuous vertical retort plant at the Turin gasworks was built in 1930 and is heated by step-grate producers. The W.-D. plant at the Rome gasworks, erected in 1938, is equipped with mechanical producers. Each battery of retorts is downwardly heated and the plants are of similar carbonising capacity (actually 240 tons a day at Turin and 236 tons a day at Rome). The step-grate producers at Turin are of the built-in type of standard W.-D. design. The mechanical producers at Rome have an internal diameter of 3 m. and have revolving grates, of special design. They were manufactured by S.A.F.I.I., of Milan; the grates being covered by Italian patent S.A.F.I.I. 388783.

The following figures relate to a test period of the two settings covering two months.

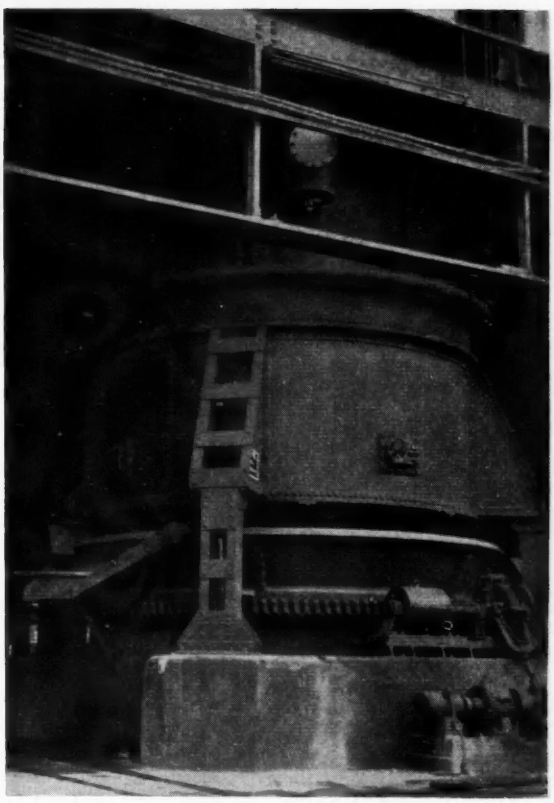
Producer Charging Platform

	Turin	Rome
No. of retorts	30	2 × 16 = 32
Coal carbonised, tons per day	220.460	236.210
Dry coke (charged), tons per day	39.368	34.485
Coke analysis :		
Ash	15.2%	14.0%
Volatile matter	0.5%	0.5%
Fixed carbon	84.3%	85.5%
Net calorific value of coke, B.Th.U./lb.	12,312	12,487
Pure coke (charged), tons per day	33.384	29.657
Pure carbon (charged), tons per day	33.187	29.484
Dry ashes (discharged), tons per day	12.046	6.562
Ashes analysis :		
Ash	55%	85%
Unburnt carbon	45%	15%
Loss carbon in the ashes, tons	5.421	0.984
Gasified carbon, tons	27.766	28.500
Gas produced, cu.ft.	5,413,420	5,430,300
Gas analysis :		
CO_2	5.4%	5.2%
CO	29.0%	30.0%
H_2	10.4%	12.8%
N_2	55.2%	52.0%
Gross calorific value of producer gas, B.Th.U./cu.ft.	125	136
Net calorific value of producer gas, B.Th.U./cu.ft.	119	130
Gas made, cu.ft. per lb. of dry coke (charged)	61.35	70.15
Gas made, cu.ft. per lb. of carbon (charged)	72.71	82.16
Gas made, cu.ft. per lb. of pure coke (charged)	72.23	81.68
Temperature of producer gas entering the settings	631° C.	450° C.
Producer efficiency in hot gas entering the settings referred to dry coke (charged)	76.5%	88.47%
Producer efficiency in hot gas entering the settings referred to carbon gasified	91.0%	91.0%

The coke used for heating the setting at Turin, built as a single setting of 30 retorts, equals 17.8% of the coal carbonised. The coke used for heating the settings at Rome, built in two units of 16 retorts each, equals 14.5%. It should be noted that in the Rome plant the loss by radiation of heat is greater by about 6 mill. B.Th.U. per day, corresponding to 970 lb. of pure carbon charged to producers. If the plant at Rome consisted of a single unit similar to that at Turin, there would be an even smaller use of pure carbon—*i.e.*, 63·840 − 970 lb. = 62,870 lb. of pure carbon corresponding to 28·067 tons of charged coke, or 14.4% of the coal carbonised. The carbon content of the slag from the mechanical producers is very small. When the coke contains about 10 to 11% of ash, the slag has no more than 8 to 10% of carbon.

The coke in the ashes from the step-grate producers could be recovered, but it is impossible to recover the whole of this coke, and the recovery would be of the order of 6 to 8% of the coke supplied to the producers.

The volume of gas obtained from the mechanical producer does not vary during the period between fuel charging. Hence the gross calorific value of the gas, which is nearly constant, is always higher, resulting in higher flame temperature and better combustion efficiency. Again, the adjustment of step-grate producers is not always easy, whereas mechanical producers can be adjusted to give the best operating conditions. A further point is that with mechanical producers there is a considerable saving in labour.



The S.A.F.I.I. Producer at Rome Gasworks

The mechanical producers at Rome have a continuous life of about three years. Three producers are employed to heat the 32 retorts.

The producers have no water-jacket body. They are lined with refractory material of 42% Al_2O_3. Steam for blast saturation at 60° C. is from the waste heat boiler of the setting after use in the turbine.

The results obtained during the past ten years have been excellent, and in Italy we are now building our continuous vertical retorts to be heated by mechanical producers only.

'LET US NOW PRAISE FAMOUS MEN'

***EDITOR'S NOTE*:—For his address to the North Western Fuel Luncheon Club, Dr. D. T. A. Townend, Director of the British Coal Utilisation Research Association, chose the picturesque title, 'The Cloister and the Hearth,' by which he signalised his intention to call attention to something of the great debt the nation owes to the famous Manchester Combustion School which flourished under H. B. Dixon at the turn of the century and so to emphasise the ultimate influence of the work of the universities on the industrial well-being of the nation.**

H. B. Dixon

Harold Bailey Dixon was brought up in a home with notable literary associations, where Lytton, Huxley, Henry Irving, and other famous men were frequent visitors. In 1867 he was elected foundation scholar at Westminster School, whence he went in 1870 to Christ Church, Oxford, with a Classical junior studentship. As an undergraduate he was one of the most popular men of his time. He threw himself into every phase of the social and athletic side of university life. He rowed in the College eight, played cricket, and got his blue in association football. He was extremely fond of dancing. These activities so much interfered with his classical studies that he scarcely fulfilled the expectations of his tutors; there was even a danger that his university career might come to an untimely end. Fortunately in 1873, Dr. A. Vernon Harcourt induced the College authorities to transfer the young classical scholar to his care. Harcourt was thus the means of saving for chemical science one who was destined to be numbered among its most original and lucid exponents. For six years Harcourt and Dixon worked side by side in the crypt of one of the monastic buildings on the Christ Church site; a room which had seen the first anatomical studies chiefly upon bodies of malefactors executed within the precincts of the Castle nearby. Despite its gruesome associations however, the room made a satisfactory laboratory for chemical research.

In 1886 Dixon was elected to a Fellowship at Balliol, but a year later he moved to Manchester, where he succeeded Sir Henry Roscoe as Professor of Chemistry at Owen's College. Perhaps Dixon's most notable discovery at Oxford (1877) had been his observation that prolonged drying of carbon monoxide and oxygen rendered their mixture incombustible. It may here be recalled that this discovery was the start of the series of researches by his collaborator H. B. Baker, which established the importance of the presence of water vapour not only in combustion processes, but in a wide range of gaseous reactions.

Dixon's further work at Manchester was concerned with, among other things, photographic studies of flame movement in gaseous explosions, the part played by compression waves in detonation, and the determination of ignition temperatures. He followed up closely the researches of the French savants, Mallard, Le Chatellier, Berthelot, and Vielle. He was one of a constellation of famous scientists at Owen's College; his contemporaries included Horace Lamb (mathematics), Schuster, Rutherford, Osborne Reynolds, Petavel (engineering), and Schorleimer (organic chemistry). His own students included such men as W. A. Bone, D. L. Chapman, J. B. Cohen, A. Harden, J. W. Mellor, Robert Robinson (now President of the Royal Society), E. J. Russell (President of the British Association), J. F. Thorpe, Harold Hartley (now Chairman of Radiation, Ltd.), H. Levinstein, R. Lessing, and R. V. Wheeler. The men who interest us most, of course, are the fuel technologists, Bone, Wheeler, Hartley, Lessing, and (he would also mention) Coward. The success of all these men is striking testimony to Dixon's ability as a teacher. His singularly clear and penetrating mind referred everything to the final test of well-ordered experiment, critically carried out without hurry or bias, with results checked at every conceivable point.

Always ready to serve in the public interest, in 1881 Dixon experimented (for the Board of Trade) on standards of light to be used in photometry; in 1891 he served on the Royal Commission on Explosions of Coal Dust in Mines; and in 1902 on the Royal Commission on Coal Supplies. Although he retired from his Chair in 1922 he continued experimental work on behalf of the Safety in Mines Research Board. Before his sudden death on September 18, 1930, he made a further striking contribution to the science of fuel by his discovery of the important part played by NO_2 in gaseous combustion.

W. A. Bone

Dr. Townend passed on to his own tutor, Bone, without question, he supposed, the most distinguished fuel technologist of the present century. After spending a year at Ley's School, Cambridge, Bone went in 1888 to Owen's College, Manchester, for training in chemistry and physics with the intention of joining the new enterprise of his uncle, T. C. Hutchinson, at the Skinningrove ironworks. Coming under the magnetic influence of Dixon, however, he was soon diverted from this intent and into the paths of scientific investigation; but never did he lose his industrial interests. Born and bred on Teeside amid the smoke and din of iron smelting, steel furnaces, rolling mills, engineering, and ship yards where, to use his own words, 'thousands of tons of coal were daily swallowed up and the night sky reddened with the blaze thereof,' he was from childhood ever a fire-gas industry are a model for such co-worshipper, with an enthusiasm which was to have results far beyond what he himself had imagined.

Hardly a week passed in his later career without Bone making some reference to Dixon's department; he always described it as a school of vigorous research whose discipline was such as only strong men could stand. Bone was an apt pupil and, having discerned the essential characteristics of his master's teaching, he passed them on embellished with the marks of his own dominant personality. After graduating, he took up research under Dixon with his fellow student Bevan Lean, and his first paper, 'The Behaviour of Ethylene in Explosions with less than its own volume of Oxygen,' was published in 1892. Thus began Bone's long record of scientific investigation extending over 46 years.

In 1896 he went, with the aid of a scholarship, to Heidelberg, where he worked on a problem in organic chemistry under Victor Meyer. Returning to Owen's College, he worked in the same field with W. H. Perkin junior, and later with his other collaborators, the results being published in a series of papers, the last of which appeared in the Transactions of the Chemical Society in 1904. It was during this period that Bone began new investigations into the combustion of hydrocarbons which were to constitute one of the main features of his life's work.

In 1906 Bone was invited to Leeds University as Professor of Applied Chemistry, and here he developed the first University Department of Fuel Technology in this country. He frequently described to his pupil (Dr. Townend) the earlier visits to Owen's College of Professor Smithells, of Leeds, who, he alleged, came to pick up crumbs which fell from the rich man's (Dixon's) table. At any rate there can be no doubt at all of the important part played by Smithells in pressing for such a department in Leeds University.

The gas industry endowed the Livesey Chair in 1910 and Bone became the first Livesey Professor, the first Professor of the Coal Gas and Fuel Industries. He organised the work of his new Department over a wide field, including metallurgy and the technology of refractory

materials, and so successfully were its foundations laid that it continued to run until 1942 on the lines originally laid down.

The researches which have been carried out at Leeds in collaboration with the operative effort. Dr. Townend recounted just a few of them. The first Report of the Joint Committee gave an account of work done by Dr. E. W. (now Sir Ernest) Smith on the development and application of a method of conveniently measuring the radiant effect of a gas fire. Subsequently researches covered a wide range of problems of gas manufacture and utilisation of immediate importance to the industry. Many of the results have been translated into standard practice. Special mention might be made of investigations into the performance of the newer systems of carbonisation, the performance in use of different grades of gas (providing a technical basis for the Gas Regulation Act of 1920), steaming in continuous vertical retorts, the influence of alkalis on the reactivity of coke, the thermal efficiency of water gas plant, the combustion characteristics of town gas, the possible applications of infra-red radiation in industrial drying processes, and, lastly, the work of Dr. Dent and his colleagues on the high pressure gasification of bituminous coals, work which was continued during Dr. Townend's own tenure of the Livesey Chair. The long list of Gas Research Fellows at Leeds includes such well-known names as Forshaw, Hartley, Dugill, and Hollings.

Of all Bone's investigations, pride of place must be accorded to his work on the slow and explosive combustion of hydrocarbons. It is well known that he discovered the formation of a series of intermediate compounds which arise in successive stages of hydroxylation. In the earlier years of the century his work, with Wheeler, Andrew, and Hartley, on catalytic combustion, in many ways anticipated current theory which is the basis of many industrial syntheses. Perhaps better known in industry is his work with McCourt on incandescent surface combustion, a means whereby a homogeneous explosive mixture of gas and air can be burned without flame in contact with a granular solid. In this connection the quite recent developments by Mr. Gunn at Leeds of furnace heating with permeable linings are of great interest. The process may logically be termed reverse surface combustion. Dr. Townend expresed the view that a greater use will be made of such systems, as the years go by, particularly with advances in the production of high-duty refractories. While still at Leeds, Bone had taken up the subject of gaseous explosions at high pressures, on which Newitt and Townend later collaborated with him at South Kensington. The outcome of this work was the development of the high pressure laboratories at the Imperial College.

In 1912 Bone was invited to develop a new Department of Chemical Technology at the Imperial College. He was succeeded at Leeds by Prof. John W. Cobb. Bone threw himself into this new field of activity with characteristic vigour and, in spite of the interruption of the first world war, there was built up under his leadership a research school of world wide reputation. On his retirement in 1936 he left behind an organisation of which he could feel justly proud. As Emeritus Professor, during the last two years of his life he was provided with accommodation at the College where he continued investigations in those fields in which he still maintained a particular interest.

Bone always maintained close contact with industrial practice. As President of the Chemical Section of the British Association in 1915 he put forward a strong plea for a more adequate scientific control of fuel consumption and the utilisation of coal generally. Indeed his efforts played a great part in the development of a national body for fuel investigation, culminating in the setting-up of the Fuel Research Board in 1918.

While at Leeds he collaborated with Wheeler in investigations into gas producer practice in experiments at the iron and steel works of Messrs. Monks, Hall, at Warrington. This work was mainly concerned with the optimum temperature of the steam blast. At the Imperial College he engaged in research, in collaboration with a group of workers including L. Reeve and H. L. Saunders, into the reactions occurring within the blast furnace, a research still going on under the British Iron and Steel Research Association. While Bone was still in harness the laboratory investigations were extended to the field at both the Appleby Works of the Frodingham Steel Co. and Skinningrove where, by means of special sampling tubes inserted at various points into the walls of furnaces, studies were made with plant in operation of both the composition of the gases and the reduced state of the burden.

Finally, Dr. Townend referred to Bone's work, commenced after the first world war, on the constitution of coal. At first he worked on solvent extraction, but later he turned to the oxidation of coal and, having isolated all the benzene carboxylic acids, with the exception of benzoic acid, he demonstrated in striking fashion the essentially benzoid structure of the main coal substance—a view which, while not entirely accepted to-day, was a great advance at the time. In the Pittsburgh laboratories these aromatic acids have been produced from coal at a cost which competes with that of other methods in the chemical industry. Bone was a sick man when he edited for publication the results of an extensive investigation into this subject. The paper appeared in the *Proceedings* of the Royal Society early in 1938, a month or two before his death.

R. V. Wheeler

Richard Vernon Wheeler was educated at Plymouth College. He came under the spell of Dixon at Owen's College where he graduated in 1903. Even before graduation he had started his career as a research worker, collaborating in Bone's work on the oxidation and combustion of hydro-carbons. From Owen's College he went as gas plant manager to Messrs. Monks, Hall's works at Warrington, where he collaborated with Bone in the series of tests on the use of steam in gas producer practice, referred to above.

In 1908, Wheeler was appointed chemist for the large-scale tests on explosions of coal dust begun by the Mining Association at Altofts Colliery, Yorkshire, and continued by the Home Office at Eskmeals, Cumberland. He published two classical series of papers, in collaboration with T. F. E. Rhead, on the reactions of carbon with oxygen and carbon dioxide. In 1920 he was appointed to the Chair of Fuel Technology at Sheffield University, but he still retained his Directorship of the Eskmeals Experimental Station, and when, in 1921, the Miners' Welfare Fund provided money for research into the health and safety problems of mining, the Safety in Mines Research Board was set up and he became its director. Laboratories were built at Sheffield and Buxton. The programme included work on explosions of firedamp and coal dust, the spontaneous combustion of coal, shot firing and blasting, the use of electrical equipment underground, and the improvement of the miner's lamp. Incidental work done under his direction of the constitution of coal, the ignition, inflammation, and combustion of gases, and the propagation of flame, have enriched the records of many learned societies.

The Manchester Combustion School

The contributions of Dixon, Bone, and Wheeler to fuel technology were themselves all outstanding, but it is only when to-day we review the far-reaching influence of their pupils throughout the country that the full influence of the Manchester Combustion School becomes really apparent. Professor R. J. Sarjant, the present holder of the Chair at Sheffield, was a pupil of Bone at South Kensington. He became the first professional fuel technologist in industry in this country under Sir Robert Hadfield. Professor Stacey Ward, another of Bone's pupils, became in the early 30's a member of Professor Moss's staff in the Mining Department at Birmingham University. He introduced there the first degree course in coal utilisation, to-day joined with oil technology in an omnibus course in chemical engineering. Ward himself now holds the Chair of Mining. Dr. A. Parker, passing by way of Birmingham, Manchester and Leeds and the Water Pollution Board, is now Director of Fuel Research; and A. C. Monkhouse, his Assistant Director, is also a Leeds graduate. Newitt, Finch, and Townend himself, all former members of Bone's staff at South Kensington, today occupy the Presidential Chairs of three of our leading Institutions.

Recent Developments

Dr. Townend concluded his address with a very brief account of recent developments and the present trend of the science of combustion. He illustrated his remarks by the manipulation of marbles and billiard balls in a manner to which we cannot do justice here. He drew attention to developments in the field of the kinetics of gaseous reactions. Until about 1914 we still thought that water was formed by triple collisions between two molecules of hydrogen and one of oxygen, and similarly carbon dioxide by the collision of two molecules of carbon monoxide with one of oxygen It is now appreciated that bi-molecular collisions are a far greater probability than tri-molecular collisions. The ultimate formation of water, for instance, involves a probability of at least nine bi-molecular collisions before the stable product is formed. And now we appreciate the

fundamental character of the observations of Dixon on the paramount importance of the presence of water in combustion processes; for water provides the molecular fragments which participate in the collisional stages in the combustion of carbon monoxide. Water is, therefore, regarded as a promoter of such reactions. The influence of such substances as the halogens, as demonstrated in the work of Wheeler, and the well-known action of lead tetra-ethyl in internal combustion engines, classify these as inhibitors. On the one hand reactant centres are provided; on the other reactant centres are put out of action. When we look at flames we distinguish molecular fragments; we know that the green tinges are due to C_2, the violet to CH, and the light blue colour of the hydrogen flame to OH.

While today atomic disintegration is much in the public mind, the combustion chemist is still concerned with the parts played by atoms as such. It was pleasing to Dr. Townend to record that the first demonstration of the presence of hydrogen atoms in flames was effected in experiments at Leeds in connection with studies undertaken for the gas industry in the production of light by luminescence. The first demonstration of oxygen atoms was made concurrently by Dr. Gaydon at the Imperial College in connection with spectrographic studies and by Dr. Whittington at B.C.U.R.A. in connection with deposit formation in stoker-fed water tube boilers. It is interesting also to note the determining part in the luminosity of, and smoke formation in, flames played by hydrogen atoms, as well as in the combustion characteristics of solid fuels. Thus does the study of combustion continue and advance step by step from such basic observations as were made by H. B. Dixon half a century ago.

A Moral

All these men were individualists. All important discoveries are the outcome of the work of individuals, and there is no field of activity in present-day life as in that of scientific endeavour in which it is more important to maintain the freedom of the individual. Team work becomes more and more necessary, but the successful leader of a team is he who will get the best out of the individuals constituting that team. One cannot regiment scientific endeavour—the individual must be encouraged as a member of the scientific family.

The Northern Division of the National Coal Board, which comprises the Durham, Northumberland, and Cumberland coalfields, has been divided into two divisional boards responsible respectively for administering the Durham coalfield and the coalfields of Northumberland and Cumberland. The new divisions are now known as the Durham and the Northern (N. & C.) Divisions. Mr. E. H. D. Skinner, Chairman of the present Northern Divisional Board, is Chairman of the new Durham Divisional Board, and Mr. James Bowman, hitherto Vice-President of the National Union of Mineworkers and General Secretary of the Northumberland Area of the Union, is Chairman of the Northern (N. & C.) Divisional Board.

Transport Costs and Gas Prices

POSSIBLE rises in the price of gas to meet further increases in transport costs were indicated on January 5 when the Transport Tribunal, sitting in London as a consultative committee and hearing an application by the British Transport Commission for authority to increase railway and canal freights and dock dues by 16⅔%, was told that the Commission's object was to prevent a further substantial deterioration in its finances. It was not seeking to pick up the £25 mill. deficit already existing.

Mr. **R. H. Wilson,** Comptroller of the Commission, agreed that in 1937 the railway staff totalled about 543,000 and that freight train tonnage carried was 298,000,000. In 1938 the staff totalled 557,000 and the tonnage carried was 266,000,000; in 1948 the staff had risen to 650,000 and the tonnage carried to 276,000,000. During 1948 a decision was taken to reduce staff by 26,000 to 624,000.

Conflict of interest between the nationalised transport system and the three nationalised fuel industries was revealed by opposition from the coal, gas, and electricity industries.

Mr. **W. J. K. Diplock,** K.C., for the National Coal Board, said that with counsel for the Gas Council and B.E.A. the whole of the coal class traffic carried by rail was represented. The board's interest was two-fold. In the first place it had an interest in its own internal traffic on the railways, both supplies which it bought for its reconstruction programme and for general maintenance, and also the internal traffic between, for instance, mines and washeries and mines and coke works.

Export prices of coal could not be readjusted to bear higher freights, but with the statutory obligation in the Coal Act to supply coal to domestic consumers at prices 'best calculated to further the public interest in all respects,' it had to keep prices as low as possible. The board would ask for preferential tariffs through greater increases on other traffics where transport was not such a big item in costs. Any increase in the cost of coal was reflected in heavy industries' costs, and increased their export prices.

Mr. **H. Royston Askew,** for the Gas Council, said gas consumers would have to bear an additional £2 mill. a year if the freight rise was approved. The Gas Council had no reserves to cushion the increase, and the Gas Act charged them with paying their way. They had no alternative but to pass it on.

Mr. **E. S. Fay,** for the British Electricity Authority, said that if the proposed additional charges were made the electricity industry would have an extra burden of £1,500,000 a year, or £1,750,000 if the increases were extended to the canals.

Mr. **B. MacKenna** (for the British Federation of Wholesale Traders and other bodies) asked what further economies could be achieved on the railways. Mr. **Wilson** replied that the possibilities of immediate economy were not very great, partly because many had already been made. The Transport Commission did not consider its staff was excessive by normal standards, but 'there must be room somehow, somewhere, to obtain further economies.'

Mr. **David Blee,** a member of the Railway Executive, said that railways estimated that freight receipts from coal, coke, and patent fuel would be £2,400,000 more this year than last. The N.C.B.'s forecast of production for 1950 was 218,000,000 tons of deep-mined coal and 15,000,000 tons of opencast coal. The railways carried about 76% of the total coal output.

South Eastern Gas Consultative Council

The frequency of the clearance of prepayment meters was discussed at the second meeting of the South Eastern Gas Consultative Council, which was held on January 3 at 4-6, Wandsworth Road, S.W.8, under the chairmanship of Alderman A. C. Warwick, J.P.

The **Chairman** reported that a letter had been received from the Croydon Branch of the National Union of Municipal and General Workers deploring the practice of clearing prepayment meters once a quarter. The branch considered it an injustice to the consumer who was held responsible for the money in the meter, and requested that the former practice of a six-weeks' clearance should be restored. The letter had been passed on to the Secretary of the South Eastern Gas Board, Mr. R. H. Sandford Smith. The Secretary's reply to the council, the Chairman continued, was that in general prepayment meters were emptied twice quarterly with the exception of shilling meters. Substantial economies were effected and the task of the collectors was facilitated by this method, and in persuading the consumer to use silver he was troubled with only one visit per quarter. Meter robberies were a rare occurrence, and it was felt that in view of the recognised need for maximum economy the current practice should not be altered.

The council also considered the question of providing the consumer with information on the quality of the gas in his area. The matter was raised by a member of the council who pointed out that it was laid down in the Gas Act that the public should be in a position to know both the quantity and the quality of the gas supplied. Prior to nationalisation, he said, local authorities had powers to appoint gas inspectors and their reports were available for public inspection. He felt that gas inspectors should make similar reports to the consultative council.

The **Chairman** replied that the functions of gas inspectors were now the responsibility of the Minister; a quarterly statement relating to the calorific value of gas supplied by the various undertakings in their area was supplied to the council. This would be circulated to the members for the attention of the council's district committees and would be available to the Press.

Queensland's Coal Resources

Results of a Preliminary Survey

IT is announced from Brisbane that the report prepared by Powell Duffryn Technical Services, Ltd., on the coal resources of Queensland and their future development had been published by the Queensland Government. The full report is a considerable document of some 300,000 words, with many tables, graphs, photographs, maps, and plans.

Since the important Blair Athol coalfield has been made the subject of a special statutory concession in favour of Central Queensland Development (Pty.), Ltd., the report—with one minor exception—excludes all mention of this particular deposit.

A brief resumé of the history of the Queensland coal industry shows a total output increasing from 1,579,024 tons in 1946 to a rate of 1,994,890 during the second half of 1948. Up to date most of the seams worked have been shallow deposits capable of exploitation without much expenditure, which tended to result in over-production and price-cutting.

There is at present insufficient evidence on which to base any good estimate of the total coal resources of Queensland. The area is immense, and the time during which geological investigation has been carried out has been comparatively short. It is recommended that the Geological Survey in Queensland should be strengthened in order to obtain the necessary information. The report states, however, that from a preliminary survey the following conclusions can be drawn from laboratory examination of Queensland coals :—

(a) Queensland possesses a wide range of types of coals, including :—
  (i) Normal coals.
  (ii) Coals containing more than normal proportions of hydrogen.
  (iii) Coals containing less than normal proportions of hydrogen.

(b) The normal coals possess properties generally similar to those of British coals of the same maturity, but coking properties appear in less mature coals than is the case with British coals.

Coking Properties

(c) The per-hydrous coals also develop coking properties at a lower maturity than British coals and, in addition, give higher yields of oils and tars on carbonisation than British coals of the same maturity.

(d) The sub-hydrous coals are extremely reactive towards oxidation, which suggests that they will behave satisfactorily in boiler and gasification plant. Sufficient is not yet known of their properties and further work is required before positive recommendations can be made as to their use for applications other than as fuels.

(e) In general, the sulphur contents of Queensland coals are lower than those of British coals. This is a point in their favour, but the coals are usually associated with higher proportions of mineral matter, which reduces their value for many purposes unless they are first cleaned.

(f) Small-scale laboratory washability tests indicate that a number of Queensland coals may be cleaned satisfactorily provided the size of the coals is reduced before cleaning.

(g) The cleaning of the coking varieties of coal improves their coking properties. Investigations on a larger scale in the field are required, however, before positive recommendations can be made on this point.

(h) Certain of the coals should be cleaned before carbonisation to bring the ash content of the coke to less than 15%, which is the utmost that can be regarded as satisfactory for general use. This does not apply to coke used for special purposes—*e.g.*, in gas producers—providing the ash fusion temperature is high.

(j) Many high-class coking coals are available, particularly in the Collinsville coalfield, while other promising coking coals are to be found in the North Ipswich and Burrum coalfields.

(k) Two types of coking coals are available :—
  (i) Coals possessing a high swelling index and also showing expansion in the Sheffield coking test.
  (ii) Coals possessing a high swelling index but showing no expansion in the Sheffield coking test.

Class (i) coals are suitable for the manufacture of coke either alone or when blended with other coals. Class (ii) coals are suitable for the manufacture of coke, if used by themselves, but not if blended with coals with a lower swelling number.

(l) The ash-fusion temperatures of nearly all the samples of coal examined so far are high, and this, combined with the low sulphur content, suggests that no trouble will be experienced due to clinker formation when using Queensland coals.

(m) In general, the reactivity of the Queensland coals is high and their ignition temperatures correspondingly low. Consequently they ignite easily and form satisfactory fuels for burning in suitable appliances.

It is recommended that further field trials in accordance with normal British colliery practice should be carried out to determine the commercial washabilities of some of the coals, and that further large-scale tests of size grading should also be carried out.

The report states that in considering the various specialised uses of Queensland coals regard has been paid solely to processes which may be of direct interest to the State, either for internal consumption or as offering promise of the establishment of a valuable export trade, or both. Accordingly, the following lines of development, which appear to be worthy of closer study, are listed :—

(a) The establishment of an iron and steel industry.

(b) The production of solid or liquid organic products from per-hydrous coals by distillation or carbonisation.

(c) The establishment of industries based on cheap electric power.

(d) Underground gasification.

(e) The production of liquid fuels and, as by-products, fertilisers and methanol by synthetic processes of the Fischer-Tropsch type.

The report concludes that :—

(a) There are no technical obstacles to the establishment of an oil-from-coal plant in Queensland able to supply motor spirit, fuel for agricultural machinery, diesel oil, and illuminating oil, to meet all the requirements of the State.

(b) Hydrocarbon synthesis by one of the modern variants of the Fischer-Tropsch process is the only method which at present merits serious consideration.

(c) As cheap and abundant coal supplies are a major factor in determining the economic feasibility of producing oil from coal in a given region, there is a prima facie case for a thorough investigation of Queensland's potentialities in this field.

(d) Oil-from-coal also requires abundant supplies of water, which need independent investigation to determine the feasibility of the project and indicate the site for the plant.

(e) Capital charges are the major item of cost and it is only by the adoption of the most modern and efficient techniques that there is a reasonable prospect of achieving an economic price.

SOFT SOLDERS

The need to economise in raw materials during the war led to the issue of a war emergency edition of British Standard 219, 'Soft Solders,' restricting the number of grades to five. It has now been found possible to revise this standard to include five antimonial and five non-antimonial solders and it is considered that these will cover all common requirements. Slight alterations have been made to the composition of some of the solders that were covered in the earlier edition. The difficulties of defining the limits of certain impurities and the absence of routine methods of determining the very small proportions involved have been recognised and the methods of specifying these impurities have therefore been modified. An appendix is included giving the melting characteristics and typical uses of the solders, while a further appendix gives more information regarding solders intended for service at higher temperatures than those for which the normal alloys covered by the standard are suitable. Copies of this standard may be obtained from the British Standards Institution, Sales Department, 24, Victoria Street, London, S.W.1. Price 2s., post free.

EDUCATION IN THE GAS INDUSTRY

The following were among the points raised and suggestions made by speakers in the discussion at the research meeting of the Institution of Gas Engineers on the 26th Report of the Gas Education Committee, which was introduced by the Chairman, Mr. John Terrace.

Mr. **H. W. Moys** (Chairman of the Board of Examiners) said that senior officials of undertakings could do much to improve the standard of examination candidates. It was, he maintained, clearly in the interests of the industry to see that the younger members were well trained, and pupilship schemes had much to recommend them. He added that the last of the intensive courses for students taking Gas Engineering (Manufacture) had just been completed. The standard reached in those courses must have given satisfaction to both teacher and student, and this method of preparing students should have application within the area boards, which could organise intensive instruction courses at appropriate centres.

Dr. **J. N. Long** (Principal, Westminster Technical Institute), remarking that the College greatly appreciated the new National Certificate scheme, suggested that it would have been better for the Institution of Gas Engineers to run the Higher National Certificates in gas engineering rather than linking up with the Institution of Civil Engineers. On the question of part-time study, Dr. Long said that in the Westminster Institute about 500 young men from the civil engineering industry attended one day a week to cover the necessary ground for the Ordinary and Higher National Certificates. So far there had been little response from the gas industry.

The Time Factor

Dr. **G. E. Foxwell** asked how the gas engineer, busy as he was with his own work, including the now ubiquitous necessity of filling up more forms and attending still more committees, was to undertake the training of juniors. He wondered whether the nationalised gas industry, now charged specifically with the task of education, ought not to appoint some education officers in each sub-divisional area. There could, in other words, be from four to 12 in each area under the area board whose job it would be to see that the young men were trained, and to advise them in their training. The pupilship scheme was another matter, and it would be interesting to know the outcome of that. The pupils in the past had paid premiums, but were they to be made to pay heavy premiums in the future with all industries competing for those young men, or should there be a scheme whereby they were automatically trained?

Mr. **J. H. Dyde** (Deputy Chairman, Eastern Gas Board) maintained that the linkage of the Institution of Gas Engineers and the Institution of Civil Engineers had the advantage that it gave an opportunity for gas engineers to pass freely from gas engineering to general civil engineering and for civil engineers to come into the gas industry. It gave greater free play for the transference of engineers from one associated industry to another. That was surely a very definite advantage. He added that it was now the duty of area boards to deal with the training of employees in the gas industry; and as education, broadly speaking, must be on a national basis, it was obvious that it would have to be co-ordinated by the Gas Council. It was to be hoped that the Council would take advantage of the excellent educational facilities the Institution could offer to the gas industry.

'The Wrong Boat'

Mr. **T. F. E. Rhead** (Birmingham) congratulated the Education Committee on bringing out what he considered to be a greatly improved scheme as regards the education of engineers, but he regretted that he must throw a bombshell into the very placid discussion. Personally, he thought it was a great mistake to link up with the Institution of Civil Engineers. Gas manufacture was a chemical engineering problem, and he thought there ought to have been a linking up with the Institution of Chemical Engineers. That should be the nucleus or centre of the education scheme. Mechanical engineers and civil engineers were incidental; they gave the apparatus; they wrapped the apparatus round the ideas which the chemists and physicists produced. This situation was being recognised by the universities. For example, Birmingham and Leeds were turning their vocational training courses into chemical engineering courses and teaching the applied science of chemical engineering. With chemical engineers at least co-equal with mechanical and civil engineers, the gas industry would by now have entered the great synthetic chemical industry; it had all the materials to hand and he thought that nothing could have prevented it if they had been of the right mind. He did not think the opposition of the chemical firms could have stopped it as they had tried to do in the past.

He felt that the wrong boat had been taken. He would not say that they had missed the boat, because he would not go so far as to say that the present scheme would not produce some good—he thought it would. But the wrong boat had been taken, and it was a boat that would not go as far as the one he had just suggested. If they had entered the great synthetic chemical industry, they could have snapped their fingers at the electrical industry when the great new dynamos came into operation—a time when the gas industry would feel the draught more than it had ever felt it before.

If Murdoch Returned

There would also have been a pushing on with the development of that very fine research work which, although he was a member, he must say had been the product of the Gas Research Board. They ought to have had high pressure technique as a common technique in the industry instead of something which had been pushed on one side. They ought to have got out of the rut of what he would call the clay-pipe stage of gas manufacture. He felt that if Murdoch could come back and see what was being done, he would not give praise, but would say, 'Good gracious, you have not done much more than I did 130 years ago.' He thought that they had advanced very little in coal gas manufacture from the chemical engineering point of view. The C.W.G. automatic process was the only real chemical engineering process they had evolved.

This brought him to the point of the future of chemists and physicists in the gas industry. At the present time it was not fair to ask a really first-class mind as a chemist or a physicist to join the industry. There was not a proper future for such people in the industry. He hoped that the nationalised body would put this right. Chemists and physicists were the handmaidens—and a very poorly appraised grade of handmaiden—to the gas industry at the present time. The right calibre of chemist and physicist ought to be lifted up to rank co-equal with the engineering side.

The Gaining of Wisdom

Mr. **A. G. Grant** (Whessoe, Ltd.) commented on the point made by earlier speakers that the soundest basis for the necessarily intermittent training at technical colleges was continuing education within the works, a point which Dr. Foxwell had supplemented with his suggestion concerning the appointment of education officers. While this might have its place, he was getting a little frightened that the appointment of specialists would take away what seemed, in this case at any rate, to be one of the very important duties of those who had charge over young men. He had been at a conference between industry and the Universities at which, among other things, there had been discussion of what supplementary courses and training should be given to people who were reading engineering or science to fit them for other fields, particularly industry. There had been talk of teaching business administration and management and the application of the things learnt to industry. One very wise conclusion of the conference had been that there should be increasingly a return to the mediæval idea of a man learning by sitting at the feet of a master, absorbing wisdom and experience as well as factual information from those who had had the opportunity to acquire that wisdom and experience. While education schemes and education officers were probably very useful catalysts and tools, all those who had charge over young men had the paramount duty of taking a personal interest in their education and should not leave that education entirely to an education officer.

Mr. **W. K. Tate** (Eastern Division, Southern Gas Board), referring to the remarks made by Mr. Grant and the suggestion put forward by Dr. Foxwell, drew attention to the responsibility of the manager or engineer for the young people

in training under them. It was his privilege to have been a pupil of the Gas Light and Coke Company in the days of Thomas Hardie, and at that time there had been a system of training of pupils in the engineering and technical branches which, he thought, was quite the best that the gas industry had had. In that scheme there had been two pre-eminent points. First, at the earliest moment possible the young pupil was given some responsibility, no matter how small the plant or how small the process. He was given that responsibility and was told 'That is yours; you have got to run that job. You probably do not know much, if anything, about it, but you can find out; you can always go to the engineer or to the assistant engineer.' The result of this method was that the pupil was proud of his responsibility, he found out all about the job and tried to do it very well, and as soon as he was master of it he began to think about what came next. It was on that foundation that the pupil began to build. The second point was one that had been rather overlooked during the discussion. It was all very well for pupils to sit at the feet of a master or of an engineer. The man from whom he could learn most in a gasworks, and probably in any other works, was the foreman.

WASTE HEAT*

By. T. NICKLIN, B.Sc.(Lond.), M.Inst.Gas E., A.M.I.Chem.E.,
Production Engineer to the North Western Gas Board

***EDITOR'S NOTE:*—The heat and power requirements of a gasworks form quite a considerable item of the total cost of gas into holder; it is therefore essential that the utilisation of surplus or waste heat and the choice of prime movers for the works should receive very serious thought. Some months ago, the author was given the task of considering the most economic use of waste heat from a projected continuous vertical retort installation, and the findings are set out in this paper.**

GENERALLY speaking, in the case of a continuous vertical retort setting, the air for combustion of producer gas is not pre-heated by recuperation or regeneration. The temperature of the combustion products leaving the combustion flues must therefore be high and may vary from 900°C. to 1,100°C. The surplus heat in the flue gases leaving the setting represents a high proportion of the total heat entering the setting, and it is of paramount importance that this surplus heat should be utilised to a maximum degree of efficiency.

With regard to the choice of prime movers, we have steam engines, steam turbines, and electric motors. From the point of view of operating efficiency the electric motor is to be preferred to the steam engine, since the efficiency of an electric motor is approximately 90% compared with an efficiency of approximately 70% for an equivalent power given by a compound non-condensing steam engine of a size normally met with in gasworks practice. A still lower efficiency than 70% is obtained by using a non-condensing turbine. The choice of a prime mover is not based on operating efficiency, however, but rather on economic efficiency, and taking the steam consumption of a compound engine (non-condensing) at 25 lb. per brake h.p. hour with steam generated from surplus heat at 1s. per 1,000 lb. the cost per brake h.p. hour will amount to 0.3d.; electricity for power purposes must therefore be purchased or generated on the works at 0.36d. per kWh. in order to be equal to steam when this steam is generated from surplus heat at 1s. per 1,000 lb. and utilised in a non-condensing compound steam engine.

It has been the generally accepted practice in our industry to meet our total power requirements for gas production and distribution by a combination of steam using prime movers and electric motors. For certain purposes the electric motor is the only prime mover we would consider using. Under such conditions, and assuming that our electric power is generated on site, the total power load cannot be met by steam produced from waste heat. One course open to us is to balance power units between steam and electricity so that the total consumption of the former does not exceed the amount produced from waste heat, and purchase electricity from an outside source. But if we generate our own electricity from steam and the additional steam is produced in solid fuel boilers then the cost of this steam will be at least five times that produced from waste heat. The cost per brake h.p. hour from such additional steam will be at least 1.5d., giving an equivalent cost of 1.8d. per kWh. for electricity. From the foregoing it will be seen that by using the steam engine as a prime mover the cost per brake h.p. hour for all power will be between 0.3d. and 1.5d.

Providing that electricity can be generated on the works to satisfy all power requirements (at the same time providing process steam requirements) at a cost equivalent to the lowest cost of steam engine power—*viz.*, 0.3d. per brake h.p. hour, equivalent to 0.36d. per kWh., it is obvious that considerable economies must be made, especially when it is considered that any additional power above that provided by surplus heat would cost 1.5d. per brake h.p. hour when this power is produced in solid fuel boiler plant and utilised in a compound steam engine.

The problem of electrical power generation and the provision of process steam requirements will be considered from the standpoint of (a) the steam turbine, and (b) the gas turbine. In order to illustrate the treatment of the problem, figures given in the subsequent parts of this paper refer to a continuous vertical retort installation capacity 6 mill. cu.ft. of gas per day, making gas of calorific value 500 B.Th.U. per cu.ft. after the extraction of 2 gal. of benzole per ton of coal carbonised.

The surplus heat available per hour amounts to 30,100,000 B.Th.U.

The heat available is the heat above 32°F. However, since it is not possible to utilise the total heat down to a temperature of 32°F. there will be some loss of heat to atmosphere depending on the temperature of discharge of the waste gases. The quantity of heat discharged to atmosphere will depend on the type of heat recovery plant. In the case of the steam turbine the heat recovery unit will be the waste heat boiler while in the case of the gas turbine the heat recovery unit will be the waste gas/air heat exchanger.

There is a proportion of the waste heat available that must be utilised for the provision of process steam. The quantity of process steam required is common to both the steam turbine and the gas turbine conditions.

Process Steam

The manufacture of coal gas is not confined simply to the carbonisation of coal where process steam is required for the production of blue water gas in the vertical retort. With the increasing difficulties being experienced in the disposal of gasworks effluent it may be assumed that the new works will include an effluent treatment plant in which process steam is required for the dephenolation, concentration, and evaporation of gasworks ammoniacal liquor. Furthermore, the benzole recovery plant is a consumer of process steam, other con-

* Abstract of a paper to the Manchester and District Junior Association of Gas Engineers.

sumers being gasholders (antifreeze) and boiler feed water heaters. Most of the process steam requirements on a gas-works can be met by the use of exhaust or pass out steam at a pressure of 15 lb./sq. in. There are certain processes in which solvents must be distilled, these solvents requiring a higher temperature for final flashing off than that provided by steam at 15 lb./sq. in. gauge (dry saturated). In these circumstances the process steam must be supplied at either (a) a higher pressure, or (b) under superheated conditions.

Low pressure process steam requirements are made up as under:—

(Steam at 15 lb./sq. in. dry saturated)	lb/hr.
Steam to retorts 2½% by weight of coal	1,000
Benzole plant (vacuum distillation)	915
Benzole washing dephenolation plant	950
Concentrated ammoniacal liquor plant	1,100
Liquor evaporation plant	2,050
Phenosolvan plant	150
Active carbon (condensate treatment) plant	100
Total	6,265

Process steam requirements other than those met by low pressure steam:—

	lb./hr.
Benzole washing dephenolation plant	350
Phenosolvan plant	125
Total	475

It will be noted that the process steam requirements for boiler feed water heating are not included in the above figures, the reason being that this quantity is not common to both the steam turbine and the gas turbine. In the case of the gas turbine the quantity of steam generated from surplus heat is equivalent to that required to meet process steam requirements, while in the case of the steam turbine the maximum quantity of surplus heat is converted to steam.

Allowing 250 lb./hr. for transmission losses:—

Process steam requirements = 6,265 + 475 + 250 lb./hr.
= 6,990 lb./hr.

The heat required for providing process steam will be supplied by waste heat together with the heat available in the water leaving the coal gas condensers which it is assumed will be used for boiler feed purposes. The proportion of the heat required to be supplied by waste heat will be equivalent to the total heat in steam above the temperature of the water leaving the coal gas condensers (120°F.) at the pressure required for process.

Electricity Requirements

Having determined the process steam requirements an analysis must be made of the power and lighting requirements of the works under peak load conditions. The following table sets out the electricity requirements of the works:—

Item	H.P. on line.
Retort house	124
Coal handling plant	130
Coke handling plant	143
Graded coke to producer feed hoppers	22
Ash handling plant	9
Total	428

Allowing { 66% Load factor. 87% Motor efficiency.

Peak load conditions for the above items of plant will absorb 325 H.P.

Electrical consumption for above items of plant = 243 kW.
Add lighting ... ... 30 kW.

Total peak electrical load for retort house, coal and coke handling plant. &c. ... ... = 273 kW.

Item.	kW. Demand.	Demand/24/hr. kWh.
Retort house coal and coke handling plant, &c.	273	3,480
Condensers (liquor transfer pumps)	2.2	53
Detarrers	3	72
NH_3 washing plant	9	216
Benzole plant	9.3	224
Purification plant (tower purifiers)	120	480
Water cooling tower pumps	25	600
Effluent treatment plant	15.95	383
Gas compression plant	280	6,720
Workshops	30	180
Laboratory	5	10
Tar and liquor pumps	2.5	60
Works lighting	50	700
Ambulance room	1	4
Stores	5	10
Kitchen and mess room	0.75	3
Offices	1.0	2
Garage	2	8
Telephone and fire alarm	1	8
Total peak instant demand for works (including compression)	835.7 kW.	13,213 kWh.

The power requirements of the works other than power scheduled under electricity requirements amounts to 105 H.P., this being made up of:—

Exhauster drive	65 h.p.
Waste heat boiler fan power	40 h.p.
Total	105 h.p.

The author then considered the utilisation of surplus heat from the aspect of (a) the steam turbine, and (b) the gas turbine.

He took the following examples:—

Case A: Exhauster and boiler fans driven by electric motors.

Case B: Exhauster driven by compound steam engine exhausting at 15 lb./sq. in. and boiler fans driven by single-crank engines exhausting at 15 lb./sq. in. (exhauster engine and fan engine to be supplied with dry saturated steam at 235 lb./ sq. in., remainder of steam from boiler to be superheated to total temperature of 700°F. and passed to pass-out turbo-alternator set; pass-out steam from turbo-alternator to make up low pressure process steam requirements with exhaust from engines).

Case C1: Compressor driven by compound steam engine exhausting at 15 lb./sq. in. Boiler fans and exhauster driven by electric motors. Compressor steam engine to be supplied with dry saturated steam at 235 lb./sq. in., remainder of steam to be superheated to 700°F. and passed to live steam turbo-alternator set condensing at 28 in. Hg. vacuum. Exhaust steam from compressor to be used for process low pressure steam requirements.

Case C2: Compressor steam engine supplied with steam at 180 lb./sq. in., having a total temperature of 600°F., the remainder of the steam at 180 lb./sq. in. and temperature of 600°F. being passed to a live steam turbo-alternator set condensing at 28 in. Hg. vacuum. Exhaust steam from compressor engine to be used for process low pressure steam requirements.

CONCLUSIONS

Power Output

The steam turbine with all-electric drive on the works gives a greater power output than the gas turbine for equal conditions of waste gas mass flow and temperature.

The power generated by the steam turbine under maximum day conditions amounts to 1,135 kW. compared with 920 kW.

NEW WORLD NEW WORLD NEW WORLD

RADIATION GROUP SALES LTD

The new selling organisation now established by Radiation Ltd. will handle henceforth the sales of all gas appliances produced by the following Firms:

ARDEN HILL & CO., LTD. - - BIRMINGHAM

CLARK'S STOVE CO., LTD. - - WARRINGTON

THE DAVIS GAS STOVE CO., LTD. - LUTON

FLETCHER, RUSSELL & CO., LTD. WARRINGTON

RICHMONDS GAS STOVE CO., LTD. WARRINGTON

WILSONS & MATHIESONS, LTD. - - LEEDS

JOHN WRIGHT & CO., LTD. - BIRMINGHAM

Radiation GROUP SALES LTD., RADIATION HOUSE, ASTON, BIRMINGHAM, 6

NEW WORLD NEW WORLD NEW WORLD

in the case of the gas turbine, a difference of 215 kW. In order to make a true comparison between steam turbine and gas turbine the power absorbed by the exhauster and waste heat boiler— *i.e.*, 105 h.p. = 78.5 kW.—must be added to 920 kW., making a total of 998.5 kW. (The power for exhauster and boiler fan being provided by steam raised in the gas turbine waste heat boiler). The difference in power output amounts to 215 − 78.5 = 136.5 kW. when overall power is taken into account.

Capital Cost

The cost of steam turbine power plan will include:—
3 waste heat boilers (one standby).
2 turbo alternator sets each of capacity 1,200 kW. (one acting as standby).
Condenser water cooling tower.

the approximate cost of the steam turbine installation being £75,000.

The cost of gas turbine power plant will include:—
2 gas turbine units with heat exchangers and waste heat boiler (one unit to act as standby).
Water cooling tower for cooling water used on compressor intercoolers and on pre-cooler.

the approximate cost of the gas turbine installation being £160,000.

The cost of the gas turbine installation is therefore more than twice that of the steam turbine installation. Taking this difference into account, together with the reduction in power output, it is obvious that the steam turbine represents the most efficient and economic method to be adopted for the utilisation of waste heat. In the circumstances it is not proposed to deal with the cost of power generation by means of the gas turbine.

Maintenance and Life

Little is known of the maintenance and life of the gas turbine, a life of 100,000 hours is estimated under full load conditions—this figure representing approximately 17 years when taking into account the load factor of the gasworks (250 full load days per annum). The life of the steam turbine is well known, many steam turbines being in operation today that are over 20 years old.

Considering the relative operating conditions with regard to temperature, it is anticipated that even with clean filtered air the maintenance of the gas turbine will be higher than that of the steam turbine.

Choice of power/process steam combination

All-electric drive (case A) gives the greatest surplus power under all conditions of working. With a waste gas inlet boiler temperature of 850°C.:—

Surplus power at peak electrical demand under maximum day conditions = 220.8 kW.
Surplus power at peak electrical demand under minimum day conditions (with augmentation to capacity of producers in operation). ... ... = 105.55 kW.

Under similar waste gas, mass flow, and temperature conditions Case B giving steam engine drive to exhauster and boiler fans shows:—

Surplus power at peak electrical demand under maximum day conditions = 159.3 kW.
Surplus power at peak electrical demand under minimum day conditions (with augmentation to capacity of producers in operation ... ... = 79.55 kW.

Surplus power available under Case A provides a good working margin to take care of reasonable overload conditions. The all-electric drive has the great advantage that the only high pressure steam user (apart from the small quantity of high pressure process steam) is the turbine. With the turbine adjacent to the waste heat boilers, transmission losses would be reduced to a minimum, high pressure steam mains would be reduced to a minimum, and exhaust steam for process use would be obtained from one unit (*i.e.*, the turbine pass out), thus simplifying exhaust steam connections on the works. The choice of power/process steam combination is in favour of case A giving all-electric drive on the works.

Estimated cost of power (steam turbine case A)

The cost of a steam turbine power unit, including standby and waste heat boilers, is approximately £75,000, the cost of three waste heat boilers representing approximately £30,000. It is proposed to charge steam generated from waste heat at 1s. per 1,000 lb., this figure including labour, maintenance, water, and capital charges on the waste heat boilers; the net capital to be charged to power generation is therefore £45,000. Since surplus power will be available it will be possible to sell power. In order to be able to distribute power into an external electrical supply system, transformers and protective switchgear are required, the estimated cost of this equipment being £10,000. The total cost of the turbine installation will therefore be taken at £55,000.

The total power generated per annum (250 maximum days) will be:—

1,135 × 24 × 250 = 6,800,000 kWh.
Surplus power per annum = 12,142 × 250 = 3,035,500 kWh.

Per annum	£	Pence/kWh.
108,600,000 lb. H.P. steam at 1s. per 1,000 lb.	5,430	0.192
3,600,000 gal. make-up water to cooling tower at 1s. 6d. 1,000 gal.	270	0.009
Operating labour (proportion of waste heat boiler labour)	500	0.018
Maintenance	100	0.004
Capital charges:—Interest 3% on £55,000	1,650	0.058
Renewals fund 3.91% on £55,000	2,150	0.078
Total cost of power generation on 6,880,000 kWh. per annum	10,100	0.359

From the foregoing it will be seen that no credit is shown for passout steam. Passout steam per annum will amount to 46,800,000 lb.; with this steam charged to process at 6d. per 1,000 lb., the total cost of power generation becomes £10,100 —£1,170=£8,930 per annum or 0.315d. per kWh.

CONVERSION FACTORS

British Standard for Conversion Factors and Tables. Addendum No. 1 to B.S. 350 : 1944 (PD.957), which has been recently published, contains additional definitions, conversion factors, multiples and tables relating to cubic measures, weights, pressures, force, concentration, and traffic units, and a set of factors and multiples and a few extended tables for the conversion of units of thermal conductivity and conductance, heat flow, and viscosity. Attention is also directed to the use which can be made of many of the basic tables, included in B.S. 350 : 1944, for the conversion of derived units. All the tables provide for two-way conversions, and as the conversion factor in the one table is the reciprocal of the conversion factor in the other, the table for converting miles to kilometres, for example, can also be used to convert units per kilometre to units per mile. This also applies to costs and the table for converting kilograms to pounds can be used to convert cost per pound to cost per kilogram, and so on. At the request of users of B.S. 350, the addendum contains an index of the definitions, factors, and tables included in the two books. The addendum costs 2s. and B.S. 350 costs 5s.

A limited number of copies of the statistical report entitled 'Statistics of the European Gas Industry' ('Les Statistiques Européennes de l'Industrie du Gaz'), presented to the 4th International Gas Conference in June, 1949, by the Association des Gaziers Belges, have been reprinted and are now available. The report contains a wealth of tabulated statistical information, up to and including 1947, with maps, graphs, and explanatory text, covering the following 16 countries: Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Great Britain, Holland, Hungary, Italy, Norway, Poland, Spain, Sweden, and Switzerland. Copies are obtainable (price 15s. each, post free), from the Secretary, the Institution of Gas Engineers, 1, Grosvenor Place, London, S.W.1.